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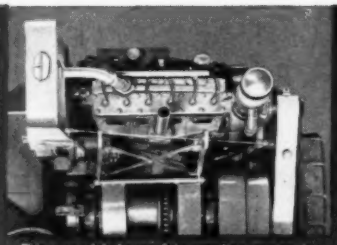
EXCAVATING ENGINEER

FOUNDED 1905

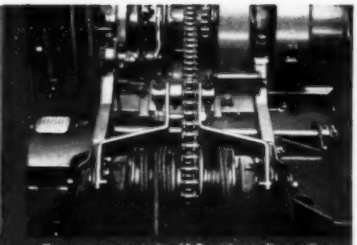
Hard at work for Uncle Sam, this bullgrader is building a road at Camp Davis, N. Carolina, where the Army is constructing a $13,000,000 anti-aircraft training center.

Vol. XXXV April, 1941 Number 4

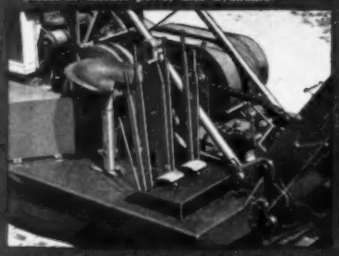
CHECK these features against any other 3/8 YARD EXCAVATOR



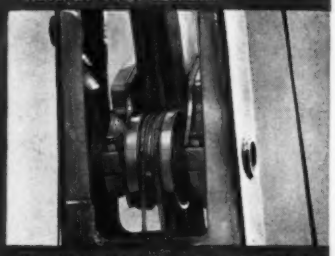
This powerful, heavy-duty gasoline engine is tailored for excavating service with special carburetion, manifolding and governor control. Diesel or electric power also available.



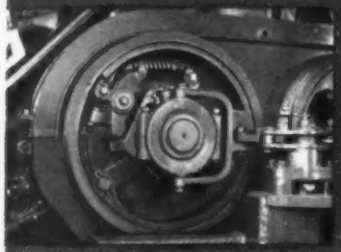
You can convert the 10-B without dismantling or adjusting the crowd-drive on boom and handle. You can also change the boom angle without crowd rope adjustment.



All controls are at the operator's position; they are easy to work and there is no awkward reaching. The big seat is fully adjustable. All machinery is conveniently accessible.

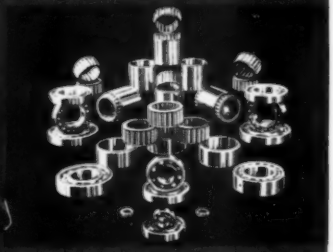


Powerful, positive twin rope crowd and high speed retract eliminate complicated, heavy and expensive wearing parts. Fully independent of all other functions.

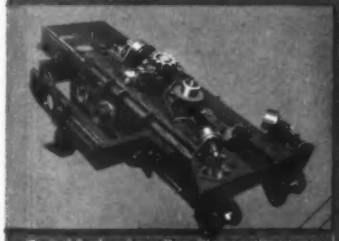


The big, identical swing, propel, hoist, drag, and crowd clutches and brakes provide immediate and uniform response to operator's touch on the control.

Here's a dipper that's in a class by itself. Welded-end-cast construction gives strength without excess weight. Curved door opens wide for quick, complete dumping.

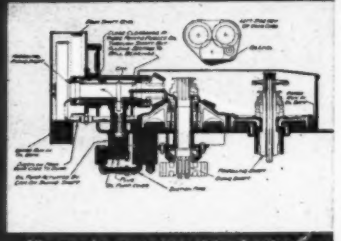


Anti-friction bearings are used on all power transmitting parts on revolving frame used in the digging cycle. Clutch adjustments are rarely necessary and easily made.

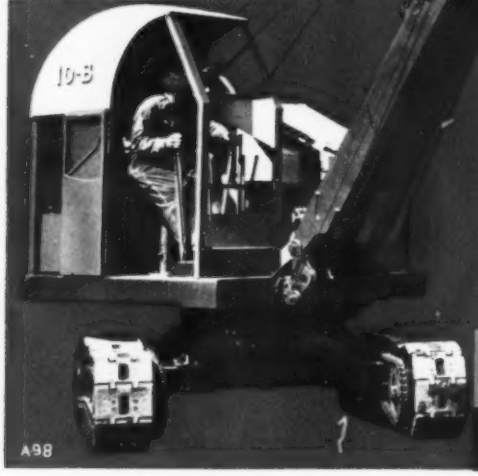


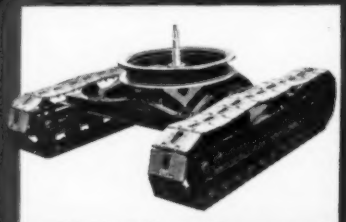
Conical hook swing rollers, lifetime adjustment. No center pintle. 3-point suspension on outer diameter of swing circle equalizes loads on a long lever arm.

The big live boom point sheaves increase rope life and add to effective boom length. Smoothness of 10-B operation due to perfect synchronization and control.



All gears for power transmitting functions—hoist, crowd, drag, swing, propel, and boom hoist—plus the multiple roller-chain from engine are fully enclosed in oil.





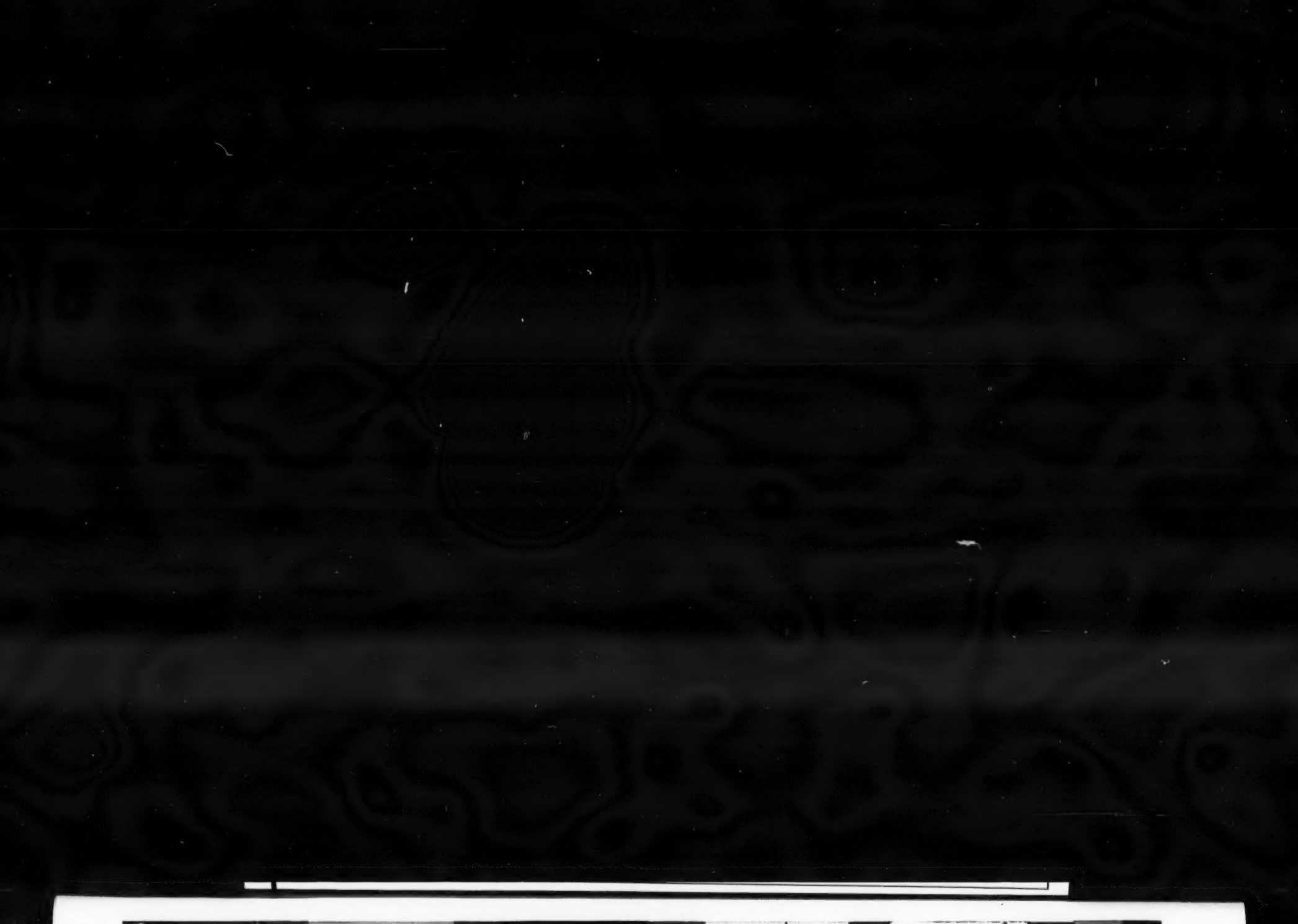
Friction clutch steering gives tractor flexibility. The 10-B climbs steep grades, maneuvers in close quarters, moves fast (to 4¼ miles per hour), anywhere on the job.

For job to job moves, the convenience and speed of Bucyrus-Erie transport wheels means less time moving . . . more time digging . . . bigger earnings.

Bucyrus-Erie Co.

SOUTH MILWAUKEE, WISCONSIN

A98



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FOUNDED 1905

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Roads at Camp Davis, near Hollyridge, North Carolina, receive the attention of a Bucyrus-Erie bullgrader mounted on an International TD-18. This $13,000,000 anti-aircraft training camp is being constructed by Grannis, Higgins, Thompson and McDevit under the direction of the U. S. Army.

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MONEY SAVING *Accessories*

Blocks and Linings

Beco Blocks and Linings take the heavy loads at the increased speeds demanded of modern excavating equipment. These Beco products are durable and tough — that's why replacements and adjustments are less frequent.

Rope Sockets

Bulldog wedge rope sockets never fail. The harder the pull . . . the tighter the grip! Attachment is easy and quick and directly in line with pull, eliminating costly kinks. Made in a dozen sizes and four different styles. Write for bulletin.

Wire Rope

Selected by the men who build your excavating and drilling machinery, Bucyrus-Erie rope has the special features that spell better performance. B-E wire rope has a uniform high quality, and comes in the right sizes, types, and construction for your exact needs. Send for wire rope bulletin.

New Bucyrus Oil Reclaimer

With the NEW Bucyrus Oil Reclaimer, used oil is reclaimed by a simple washing and filtering process at an average cost of about nine cents per gallon. It is a scientific fact, arrived at by leading research engineers and chemists throughout the country, that engine-use breaks down only the weaker and unstable molecules of your oil. These constitute about 10 per cent of the oil—the other 90 per cent, the strongest particles of the original oil, can be separated and cleaned for re-use by the NEW Bucyrus Oil Reclaimer.

Investigate the possibilities of the Bucyrus Oil Reclaimer before you discard another quart of used oil

Handy Hoist

Here is a big little helper for any hoist job around shovel or dragline, repair shop, plant, mine or pit. The Handy Hoist is a one-man tool—easy to hang, easy to handle, easy to work. Pulls up or down or sidewise, and can be readily taken anywhere on the job. Five sizes—¾ ton, 1½ ton, 3 ton, 4½ ton, and 6 ton. Write for descriptive literature.

Push-Pull Jack

No matter how unusual your "push, pull, clamp, or straightening" problem may be, BECO Jack is the tool that gives you a safe, sure, and proved means of doing the job better. Screw lengths—10", 12", 14", 16" and 18". Capacity 35,000 lbs. Send for bulletin.

Red Arch Chain

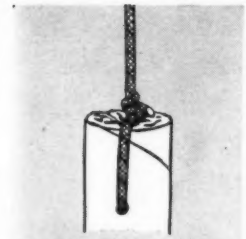
New Red Arch incandescent butt welded dragline chain has twice the strength and wearability of ordinary chain. It will save you extra money because of less shut-down time. You can get any size chain from ⅝" to 1½" to fit your bucket. Write for complete story.

T-27

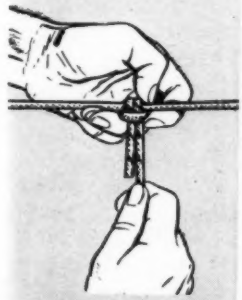
BUCYRUS-ERIE

EXCAVATING, DRILLING, AND MATERIAL-HANDLING EQUIPMENT ... SOUTH MILWAUKEE, WISCONSIN

For your convenience in writing to Bucyrus-Erie Co., you will find a card bound in this issue.

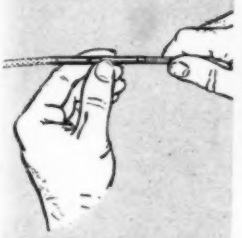


1. Tie through cartridge.



2. Half hitch branch to main line.

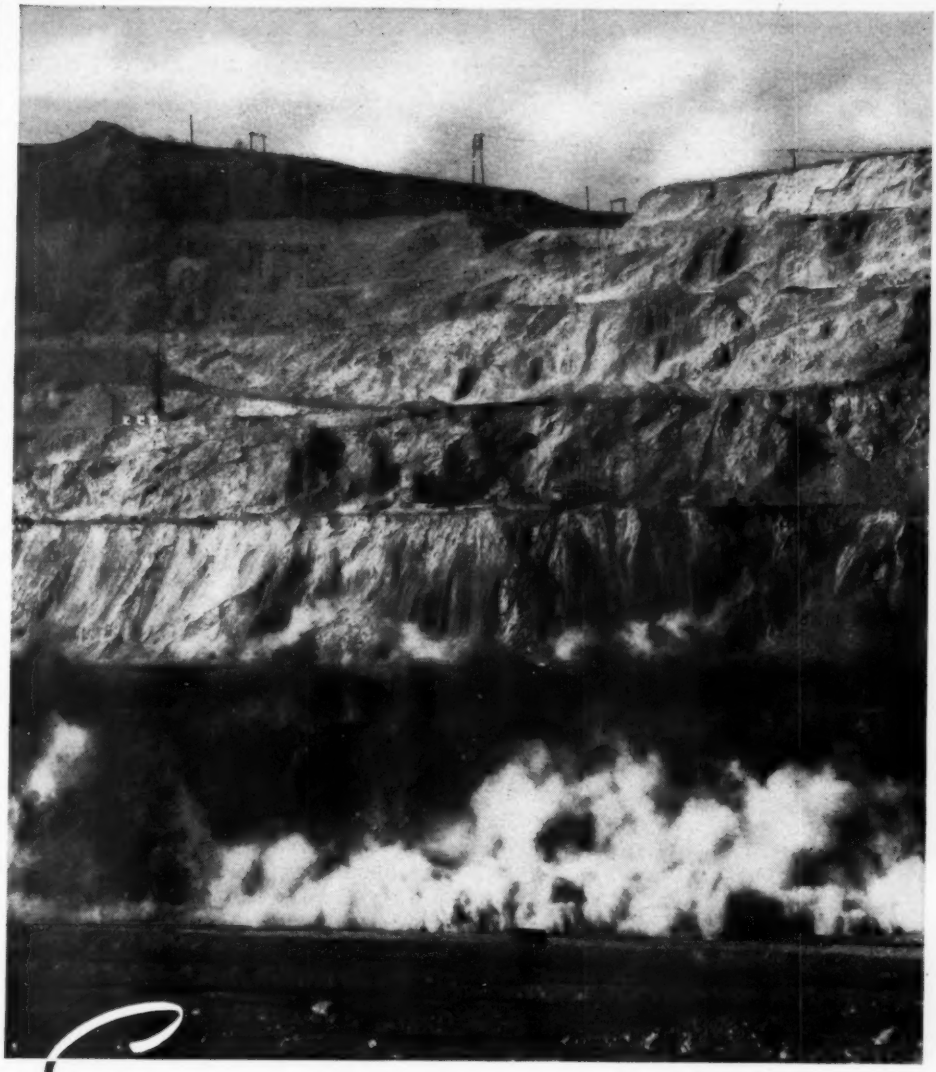
3. Connect main line lengths with square knot.



4. Fuse and cap on end of main line.

IMPORTANT

Branch lines should lead away from main lines at *right angles*. Avoid kinks and small loops.



Shooting the toe-profitably

With Primacord, you can detonate a large number of small under-cut holes placed at very close intervals—a very profitable feature when you're shooting the toe in conjunction with well drill holes.

Primacord-Bickford is an insensitive detonating fuse. Its core of PETN, within a flexible, waterproof textile cover, carries the detonating wave at nearly 4 miles per second. Yet the fuse cannot be exploded by fire, friction, or any ordinary shock but must be detonated with fuse and cap or electric blasting cap.

PRIMACORD BICKFORD Detonating Fuse

PB31

THE ENSIGN-BICKFORD COMPANY • SIMSBURY, CONN.

Makers of Cordeau-Bickford Detonating Fuse — and Safety Fuse since 1836

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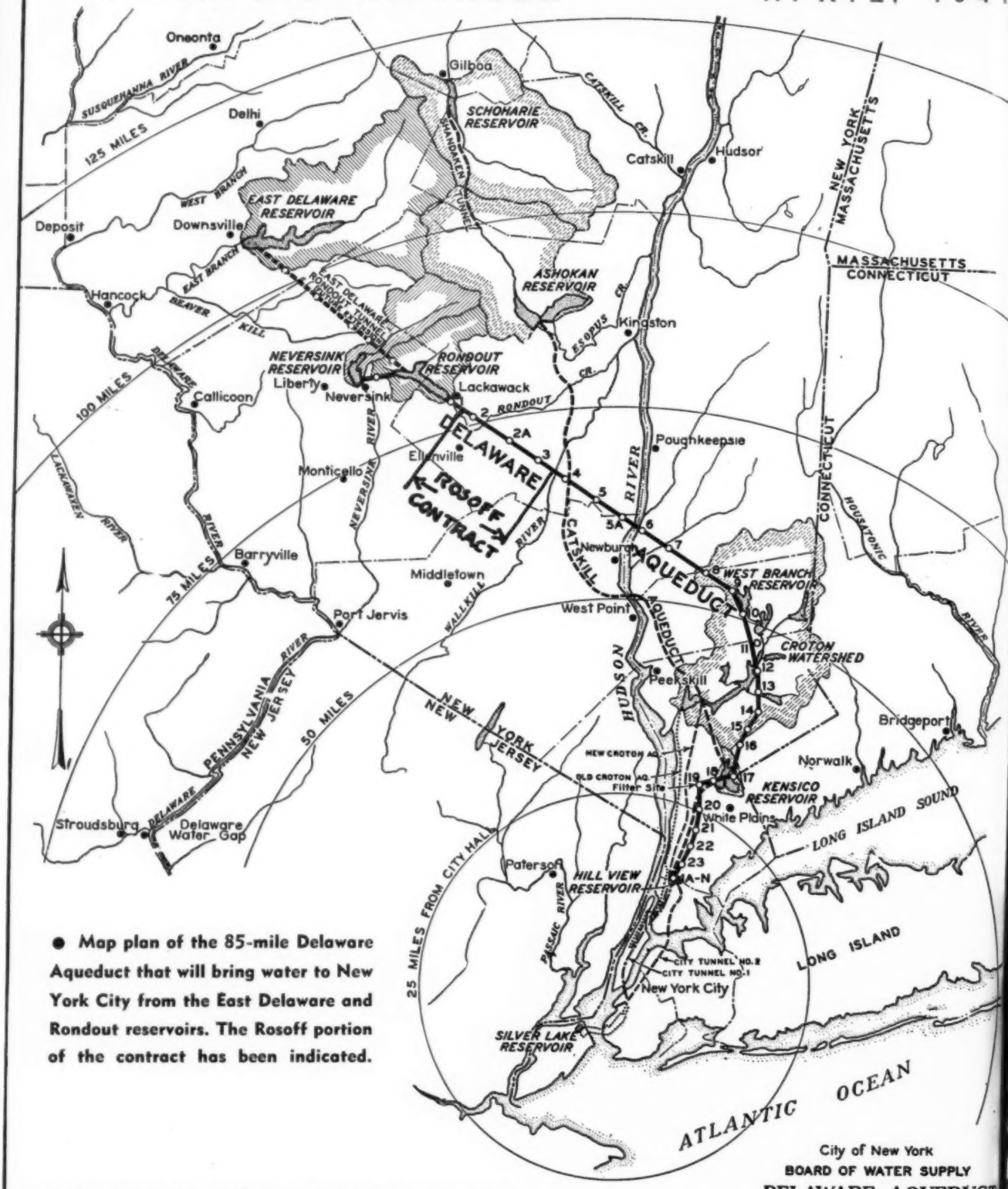


● **Map plan of the 85-mile Delaware Aqueduct that will bring water to New York City from the East Delaware and Rondout reservoirs. The Rosoff portion of the contract has been indicated.**

City of New York
BOARD OF WATER SUPPLY
DELAWARE AQUEDUCT

DELAWARE AQUEDUCT CONTRACT

Sometime in 1944 the City of New York's water problem will be solved, thanks to the present efforts of men and machinery. Here's how operations are conducted by Samuel R. Rosoff, Ltd., on the project's largest contract

By SPENCER JONES

PRACTICALLY every reader of Excavating Engineer is more or less familiar with the Delaware Aqueduct Project of the Board of Water Supply of the City of New York, which will eventually carry seven hundred million gallons of water per day on an 85-mile journey from the Delaware River and Rondout Creek watersheds to New York City. The aqueduct will be the longest continuous deep-lying pressure tunnel ever driven through rock.

The tunnel is divided into 11 contract sections, of which the most westerly, and by far the largest, is under contract to Samuel R. Rosoff, Ltd., of New York City. This 14-mile section of the aqueduct was bid at $18,916,650 and the varied tunneling problems encountered and solved by the Rosoff organization make it one of the most interesting portions of the project.

Working from the three deepest shafts on the project (Nos. 2, 2-A and 3) whose depths are 825 feet, 1,555 feet and 840 feet, respectively, the contractor must complete the job within 64 months from date of award, or by June 24, 1944.

At shafts 2 and 3, two independent tunnel headings are worked, each full face. At shaft 2-A two tunnel headings are worked alternately. The finished diameter of the aqueduct tunnel is 13′ 6″, inside the concrete lining. In each heading 4 to 5 shots per 24 hour period are made, except in the alternately worked headings of shaft 2-A, where 2 to 3 shots each are fired.

Variety of Rock Formations Encountered

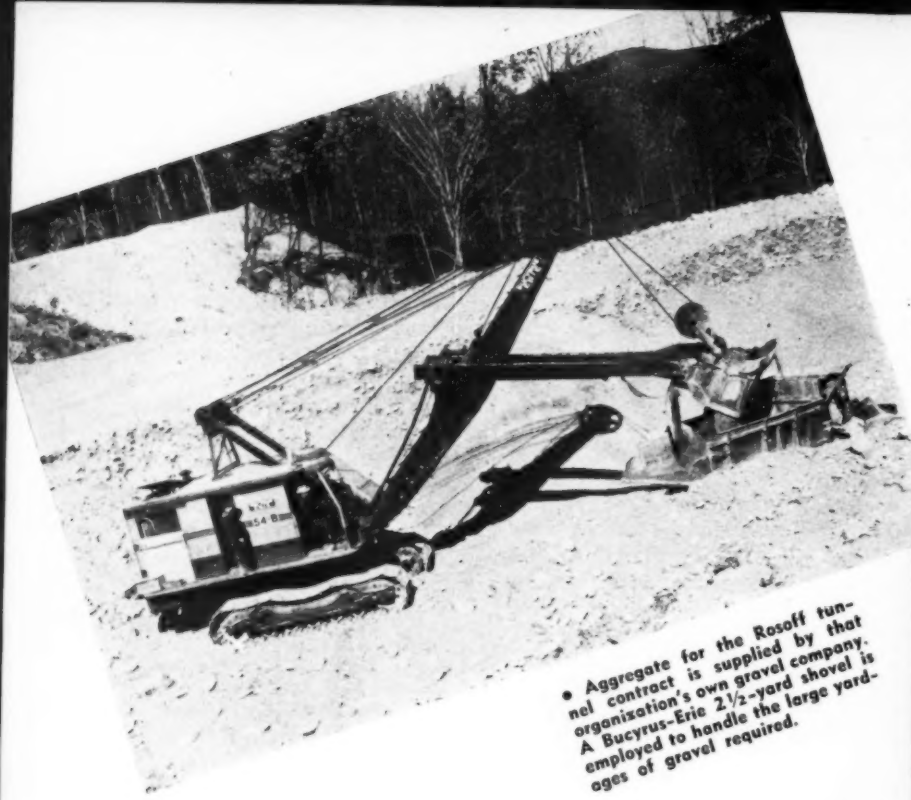
A considerable difference in cross-sections is being experienced at the various headings. Number and location of blast holes, as well as drilling speeds and powder factors are also quite different. This is due to the fact that the tunnel near shaft 2 is being cut through the hard heavy sandstone and shale of the Ashokan Formation, or Catskill Series; while the tunnels from shafts 2-A and 3 are through the softer lighter shale and sandstones of the Hudson River Series. In addition to these general variations, the contractor is frequently compelled to change drilling and blasting procedure to cope with specific local differences in rock structure from round to round.

Almost 100 per cent of the tunnel will probably have to be roof-supported, judging by present indications, hence the enlarged upper half of the bore, with the shelf on either side for holding the steel posts, wall plates and I-beam sills of the I-beam roof rafters.

Typical underground equipment at each shaft consists of:

- 2 Drill carriages. These are steel structures assembled on railroad trucks. The tunnel tracks weigh 60 lbs. per yard and are laid to 36″ gauge on wood ties.
- 24 Chicago Pneumatic drifter drills, Model 60, 3½″ bore, 24″ maximum vibration feed. Chosen because of medium weight, yet suitable for hard or soft rock.
- 2 Special cars for drill steel, also used on surface.
- 1 Special car for explosives.
- 2 Conway No. 75 mucking machines, ⅝ cu. yd. dippers, powered with 75 HP 440 volt motors.
- 60 Muck cars, rigid, non-dumping. These cars are dumped bodily by rotary car dumpers.
- 2 Cherry pickers, or car changers. These are merely air hoists which hang from tunnel roof ribs, or from bolts expanded into holes drilled

• General view at bottom of shaft 3. Hoist cage structure is in the center and rotary car dumper at the right. At the left is the shaft's pump chamber.



• Aggregate for the Rosoff tunnel contract is supplied by that organization's own gravel company. A Bucyrus-Erie 2½-yard shovel is employed to handle the large yardages of gravel required.

into the tunnel roof rock. The hoists are Gardner-Denver Model HK 2-ton Tugger Hoists. This is an inexpensive and simple method of hoisting an empty muck car out of the way.

5 Goodman electric locomotives, Class A, each with 2 Goodman DC motors, Type 154, 110 volts. Each locomotive carries 18 Exide battery units of 3 cells each, with a voltage of 2.2 per cell. Four General Electric Type 1SB-2-C-5/C-13 electric locomotives, operating on 13 volt current, were used in shaft 2 tunnel prior to the installation of the tunnel battery charging plant, but are now used on the surface.

2 Battery charging plants are installed in shaft 2. They consist of a Westinghouse 150 volt 600 amp. DC generator with Hertner control panel, and are powered by Westinghouse synchronous motors of 150 HP, using 2,300 volts, and are also equipped with Electro-Lift hoist traveling cranes. Shafts 2-A and 3 are each equipped with a 1 motor generator set, same as at shaft 2, and 1 Westinghouse battery charging rectifier No. SO 95P-461.

2 Archer Iron Works rotary car dumpers, operated by air rams at shafts 2 and 3, and by 25 HP Westinghouse type CS hoist motor at shaft 2-A.

22 Flat cars, 10 of them 6' long and 12 of them 9' long, used both in the tunnel and on the surface.

1 Rotoclone turbine exhauster for heading ventilation during drilling. These exhausters are built into the drill carriages; have 7,000 cfm capacity; are equipped with filters; and each are driven by one 20 HP motor.

1 Worthington 4-UQ1 centrifugal 4-stage automatic stand-by pump of 500 gpm capacity against a 1,000-foot head, located in tunnel pump chamber, powered with 200 HP motor is installed at shaft 3. Stationed at shaft 2 is one Worthington 4-UQ1 pump as at shaft 3 and 8 Cameron pumps, 1,000 gpm operated by 345 HP General Electric and Westinghouse motors.

2 Worthington plunger type pumps of 250 gpm capacity against a 1,000-foot head, located in tunnel pump chamber and powered with 100 HP motors. (Shafts 2 and 3.)

1 La Bour 2" self-priming pump; 100 gpm capacity against a 55-foot head; located in skip pocket and powered by a 5 HP motor.

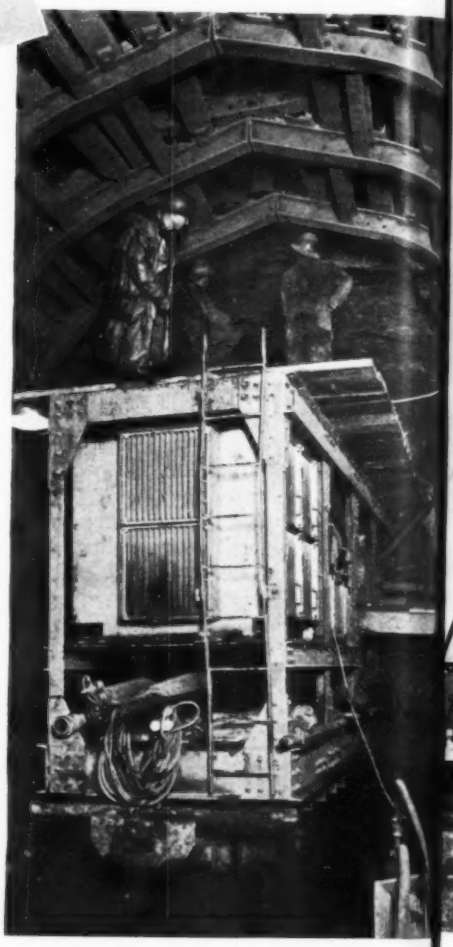
1 Worthington 4-UR1 centrifugal 6-stage stand-by pump; 500 gpm capacity against 1,800 ft. head; located in tunnel pump chamber; 350 HP explosion-proof motor. (At shaft 2-A, which is deep and gassy.)

3 Worthington 4½" x 10" plunger type pumps; 150 gpm capacity against 1,800 ft. head; located in tunnel pump chamber; 100 HP explosion-proof motors. (Also at shaft 2-A.)

Three 8-hour shifts per day are worked, each drilling and loading crew consisting of a foreman, 5 to 7 drillers, 5 to 7 helpers, 1 powder monkey and 2 nippers. It takes from 2 to 2⅔ hours for the Model 60 Chicago Pneumatic drifters, with their 24" automatic feed, to drill one complete round of holes, and from 1 to 1¼ hours for loading and blasting. Average waiting time for ventilation after each blast is 20 minutes. Average advance is 8.6 feet to 10.2 feet.

Compressed air for the drifter drills is supplied at each shaft by three Chicago Pneumatic Simplate Valve 5-step, 1,250 cfm, 2-stage compressors, delivering air at 115 lbs. per sq. in. and powered with 250 HP, 2,300 volt Westinghouse synchronous motors.

Conventional bits, forged on 1¼" round hollow steel are used. Bits are resharpened on the job. All three shafts have 2 Gardner-Denver Model 6 drill sharpeners, each, above ground, as well as 3 Gardner-Denver Model DF-1 oil furnaces, each. Shaft 3 has a



• View of the tunnel face on the south heading at shaft 2, showing a drill carriage equipped with Rotoclone filters. The carriage is mounted on railroad trucks.

Radiac drill steel cut-off machine, powered with a 7½ HP 440 volt Louis Allis Company squirrel cage motor. Drill steel is raised and lowered in a special open-end box car. The method is somewhat of an advantage because it does away with two handlings of drill steel each trip, loading into and out of the material cage.

• Headworks at shaft 3 showing the headframe, hoisting equipment, material hopper and compressor building which provide the men below ground with air and materials to work with.

Blasting Procedure

Both 40% and 60% gelatine dynamite are used and all dynamite is enclosed in red paper for quick detection of unexploded sticks in the muck. All holes are stemmed with hollow cones of soft rubber, into which tapered wood plugs are driven. Wiring is parallel bus bar, with the wires from each detonator hooked onto the two bare bus wires. The bus wires are supported by pegs driven into the rock crevices or short drilled holes. Extreme care is used to keep light and power wires separate from the blasting circuit and to provide intermediate switches in the 440-volt blasting line. The intermediate switches are closed by the foreman, the last man out of the heading before the blast, as he walks away from the heading on his way to the main blasting switch.

Each mucking crew consists of a foreman, 1 Conway mucker operator, 3 electric locomotive operators, 3 brakemen, 1 car dumper, 1 scaler, 2 scaler helpers and 5 laborers. Mucking requires 2½ to 4 hours. It involves the handling of considerably more material than might be expected, as the swell of rock is nearly 100%.

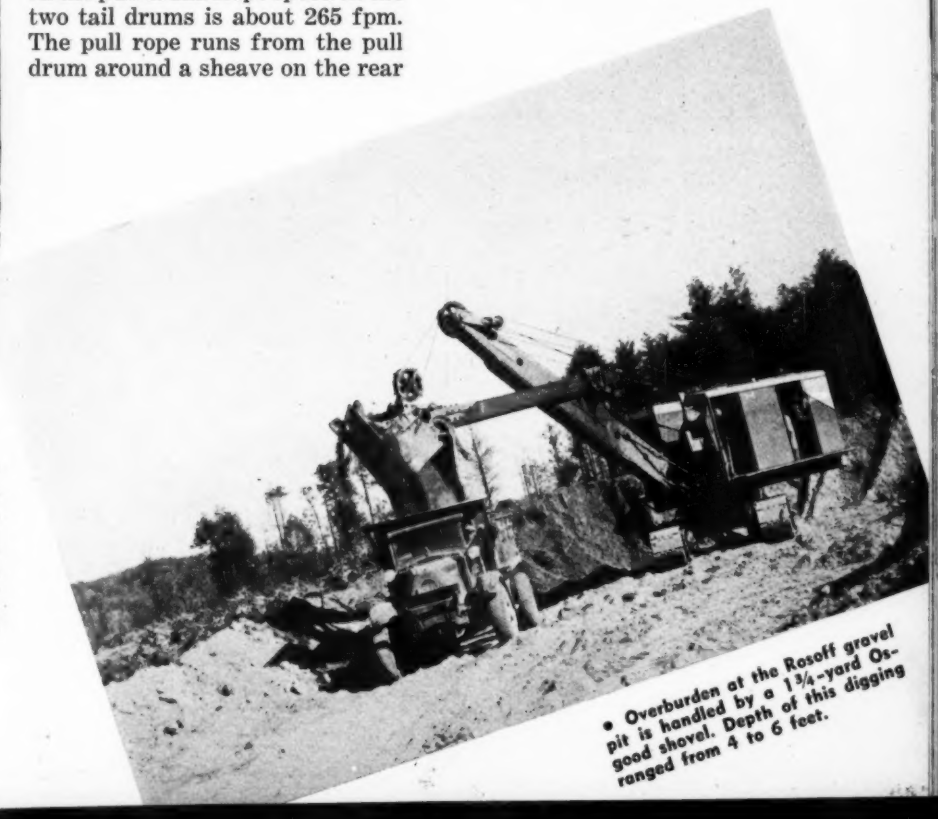
The invert is not cleaned out thoroughly until just before the concrete lining is placed, and all excavation must be complete before the lining of any section of tunnel is begun. Inverts are to be cleaned out with a Sullivan Lohite rock loader, with an electrically operated 3-drum hoist. The hoist is a Sullivan BF-312, driven by a 25 HP fan-cooled motor, producing 4,000 lbs. pull at 200 fpm speed on the pull drum. Rope speed on the two tail drums is about 265 fpm. The pull rope runs from the pull drum around a sheave on the rear boom of the rock loader and then to the front end of the bucket. The two tail ropes run from their drums around the tail sheaves and then to the back end of the bucket. The two tail sheaves are set one on each side of the tunnel, at a distance varying from 50 ft. to 100 ft. from the front end of the rock loader. The bucket can be placed anywhere within the triangle formed by the rock loader and the two tail sheaves and can also be manipulated to load rock from anywhere between the tail sheaves and the rock loader, whether in or out of this triangle.

A special Caterpillar Model D4 crawler tractor powered by an electric motor and equipped with a LaPlant-Choate bulldozer blade, designed to fit the curve of the invert, will feed the scraper of the Sullivan loader.

While drilling and blasting of the headings is still uncompleted, the muck is loaded into cars by Conway muckers; hauled to the rotary dumpers by electric locomotives; dumped into skip hoists; hauled to the surface and there wasted on spoil banks.

The steel support crew follows the muckers, setting the short steel posts, dowel pins, wall plates, I-beam sills and arched I-beam ribs or "roof rafters." I-beam

(*Continued on page 240*)



• Overburden at the Rosoff gravel pit is handled by a 1¾-yard Osgood shovel. Depth of this digging ranged from 4 to 6 feet.

TVA DEFENSE LINK

Increased electrical power requirements of expanding national defense industries located in Tennessee Valley have made Cherokee Dam a "must" project of the TVA dam system

By JOHN H. BEATTY
Assistant Civil Engineer, Cherokee Dam

THE CONGRESS of the United States on July 31, 1940, authorized the immediate construction of the Cherokee project by the Tennessee Valley Authority as an emergency national defense project in accordance with the recommendation of the Advisory Commission of the Council of National Defense. The project was needed immediately to meet the increased electrical power requirements of expanding national defense industries located in the Tennessee Valley.

On August 1, 1940, the next day after authorization, construction was started. Men and equipment were immediately moved from other TVA jobs to the construction site of the Cherokee project. The work on highway and

• Top: General view of tailed fill operations, showing wagon, dozer and sheepsfoot rollers in action. Arrow indicates top of dam. Center: Crushed rock for rock fill embankments is provided by this crusher plant. In the background is the main quarry, source of the limestone. Bottom: A LeTourneau Tournapull, carrying 30 yards of fill, leaving the borrow pit.

railroad access, construction plant and administration buildings, clearing of site, and the preparation of embankment foundations was started at once.

The principal feature of the Cherokee project is a dam 175 feet in height across the Holston River, 52.3 miles above its mouth, 3.8 miles north of Jefferson City, Tennessee, and 33 miles from Knoxville, Tennessee. Its construction will include a concrete gravity type spillway, intake, and bulkhead sections across the river valley and adjacent low grounds, totaling about 1,800 feet in length, and earth embankments on both sides of the river channel approximately 5,000 feet in length. There are also three earth dams across saddles in the reservoir rim at the south end of the main dam. They are of varying length, being approximately 300, 500 and 900 feet long.

The spillway will consist of a concrete gravity overflow section with radial crest gates and under sluices. The nine steel radial gates will be 40 feet long by 32 feet high. Norris type slide gates, 5 feet, 8 inches wide by 10 feet high, will control the eight sluiceways. The radial gates will discharge 254,000 cfs, the sluiceways 34,000 cfs, and the turbines 12,000 cfs, thus giving a total discharge capacity of 300,000 cfs. The maximum recorded discharge of the Holston River, at the dam site, is approximately 150,000 cfs, and the maximum expected flow is 300,000 cfs.

A semi-outdoor type powerhouse will be on the right bank with the substation on adjoining higher ground immediately to the north. The initial development includes three 30,000-kw generators direct connected to 41,500-hp Francis type turbines. Provision is made for the installation of a fourth identical unit at a later date. The average maximum gross head is 148 feet.

70 Miles of Road Relocation

The reservoir will have a length of 58.5 miles. The total length of shore line, including islands, will be 380 miles. The reservoir will store 1,640,000 acre feet at normal pool level. Seven unincorporated village sites, now having a total population of 800 people, will be inundated by the storage pool. Thirty miles of state highway and 40 miles of county roads will be relocated.

• Four Bucyrus-Erie 2-yard shovels of the model shown here are playing an important part in TVA's plans to complete Cherokee Dam by January, 1942. The shovel is loading 18-yard Athey wagons.

Present defense plans for completion of the project at the earliest possible date makes mandatory the utmost speed in construction operations and the avoidance of all humanly preventable delays. The progress schedule makes no allowance for interruptions and must be adhered to if the dam and reservoir are to be completed and ready to store water by January, 1942, only 17 months after the project was authorized by the Congress. The first of the three power units will be installed and delivering power by August 1, 1942, two years after the start of operations. The

second unit is to be on the line September 1, 1942, and the third unit is to be in place October 1, 1942.

Although the progress schedule called for starting the pouring of concrete on February 1, 1941, actually, concrete operations were started by January 1, 1941, or one month ahead of the approved schedule. Since August 1, 1940, the camp, dam and yard areas have been cleared; the construction camp erected; the administration and shop buildings erected; the access highway is approaching completion; the five-mile access standard gauge railroad is complete and in operation; and the construction plant is also complete. By March 1, 1941, 675,000 cubic yards of earth and 180,000 cubic yards of rock, making a total of 855,000 cubic yards of excavation, have been removed. Also, 615,000 cubic yards of rolled earth fill and 647,000 cubic yards of rock fill, making a total fill of 1,262,000 cubic yards, have been placed. A grand total of 2,117,000 cubic yards has been handled since August 1, 1940.

To do this job, as many as 2,700 men have been employed. Operations are continued throughout the 24 hours of the day on three 8-hour shifts.

The construction will require for the concrete dam, earth excavation of 220,000 cubic yards, rock excavation of 150,000 cubic yards, and the placing of 750,000 cubic yards of concrete. The earth embankments will require 1,500,000 cubic yards of rolled fill, 1,250,000 cubic yards of rock fill, 250,000 cubic yards of crushed rock fill, and 40,000 cubic yards of sand filter.

The total estimated cost of the initial development is $36,000,000 and of the ultimate development, $38,500,000.

Speed of construction is the major objective. The Cherokee project is the tenth to be constructed by the Authority, using its own construction plant and equipment, supervised and operated by its own personnel. This experienced organization and its available equipment are the major important contributing factors that account for the rapid construction of this project, which is so important to the national defense program.

Equipment Used At Cherokee

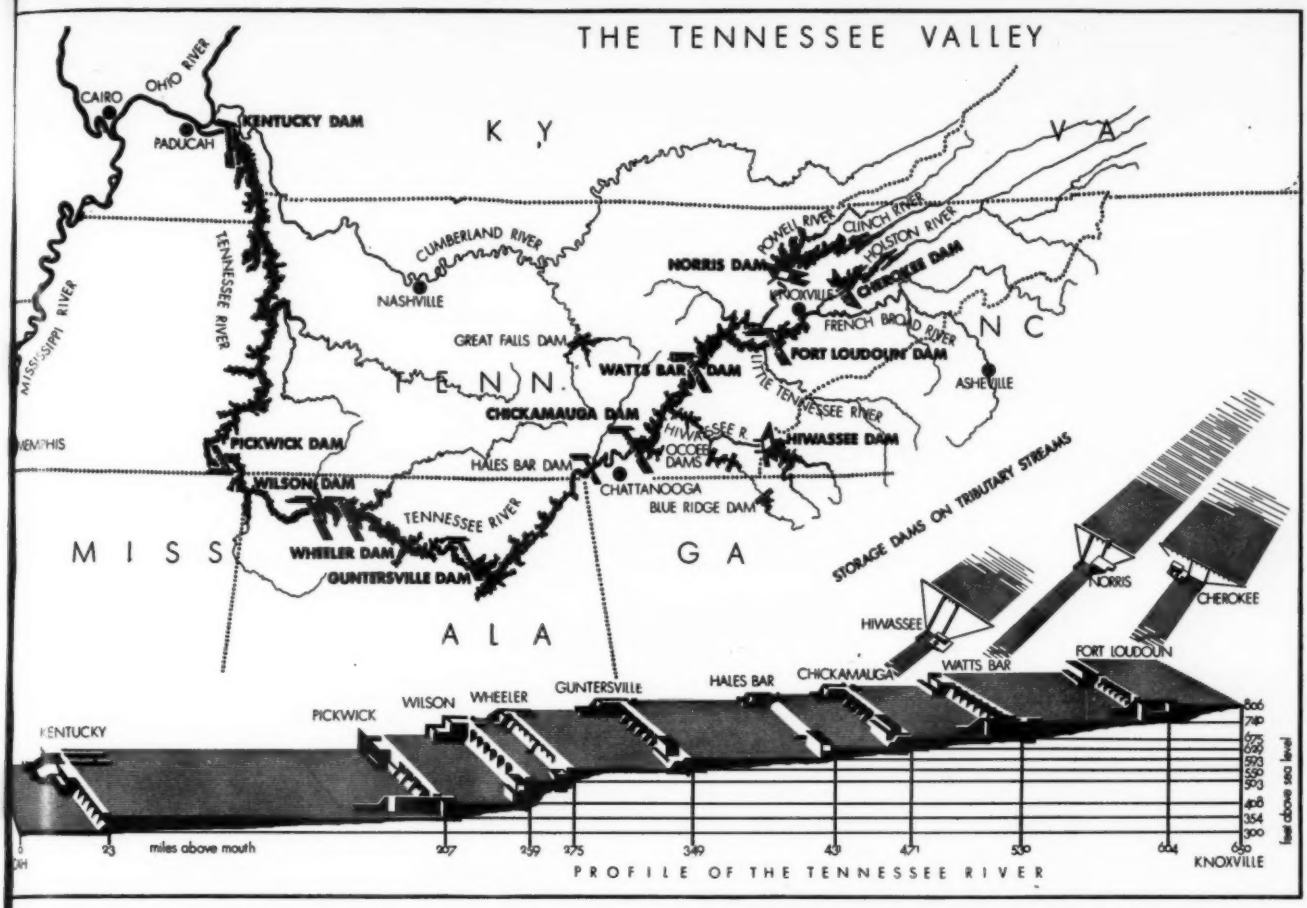
To consummate the construction, the following major equipment, owned by the Tennessee Valley Authority, is on the job:

- 4 2-cubic-yard Bucyrus-Erie 44-B shovels equipped with "Buda" diesel engines.
- 1 3-cubic-yard Bucyrus-Erie electric shovel.
- 1 3-cubic-yard Marion electric shovel.
- 3 1½-cubic-yard Northwest shovels equipped with Caterpillar diesel engines.
- 12 Allis-Chalmers HD-14 tractors equipped with General Motors diesel engines.
- 22 Caterpillar D-8 diesel tractors.
- 1 International TD-6 diesel tractor.
- 12 12-cubic-yard Hug dump trucks equipped with Cummins diesel engines.
- 9 10-cubic-yard Euclid dump trucks equipped with Cummins diesel engines.
- 1 8-cubic-yard Hug dump truck equipped with Cummins diesel engine.
- 4 5-ton G.M.C. stake body trucks with gasoline engines.
- 1 Rogers Corporation 40-ton trailer float.
- 2 Adams elevating graders equipped with International diesel engines.
- 2 Caterpillar elevating graders equipped with Caterpillar diesel engines.
- 2 2½-ton Krane Kars.
- 1 American 25-ton locomotive crane.
- 3 Clyde 40-ton Whirley Gantry cranes.
- 2 Adams Auto Patrol graders equipped with International diesel engines.
- 5 30-cubic-yard LeTourneau Tournapulls equipped with Caterpillar V-8 diesel engines.
- 1 16-cubic-yard LeTourneau scraper.
- 1 12-cubic-yard LeTourneau scraper.
- 14 18-cubic-yard Euclid Trac-Truks equipped with Cummins diesel engines.
- 16 16-cubic-yard Athey crawler wagons.
- 8 LeTourneau sheepsfoot rollers.
- 5 Blaw-Knox sheepsfoot rollers.
- 2 Euclid sheepsfoot rollers.
- 3 La Plant-Choate sheepsfoot rollers.
- 8 Rome Plow Company disc harrows.
- 2 LeTourneau rooters.
- 1 Crusher plant and loading bins.
- 1 25-ton American Locomotive hoist and derrick equipped with Caterpillar diesel engine.
- 1 70-ton American Locomotive coal burning steam engine.
- 1 30-ton American Locomotive oil burning steam engine.
- 4 10T Davenport diesel locomotives equipped with Caterpillar diesel engines.
- 3 Well drills — Bucyrus-Erie 9-inch electric.
- 1 Well drill (Keystone) Ingersoll-Rand 9-inch electric.
- 12 Chicago Pneumatic Company wagon drills.
- 2 Ingersoll-Rand calyx electric drills.
- 9 Sullivan bortz drills equipped with Hercules gasoline engines.
- 3 315-cfm Ingersoll-Rand portable air compressors equipped with diesel engines.
- 3 10-cubic-foot portable concrete mixers equipped with gasoline engines.
- 2 3,148-cfm Sullivan stationary air compressors equipped with electric motors.
- 2 Norris type grouting units.
- 2 Boulder type grouting units.

The central concrete mixing plant is electrically operated and controlled. It is equipped with three 4-cubic-yard, front charge, tilting mixers. The mixers were furnished by the T. L. Smith Company of Milwaukee, Wisconsin. At press time, two Bucyrus-Erie 44-B's, rigged as cranes, were placing concrete in the tailrace area. Two Northwest shovels were excavating in the south cofferdam area and one Northwest equipped with a backhoe attachment was operating in the powerhouse area.

Climate at the Cherokee Dam site is fairly mild, permitting

• Blasted limestone bound for the TVA crushing plant is loaded to a 10-yard Euclid truck by the Bucyrus-Erie 3-yard electric shovel.



• This map and profile of the Tennessee River gives an excellent idea of the TVA program for the unified development of the Tennessee River system, which covers an area of about 41,000 square miles, including parts of seven states, and supports a population of approximately 2,500,000 people. Twelve dams are now completed or under construction to aid in control of floods, to create a channel for nine-foot navigation and to obtain the maximum generation of electric power as a by-product.

year-around construction with a minimum delay due to frigid weather. During the winter months, temperatures at night occasionally drop into the freezing zone, but the day temperatures are usually well above freezing. The average annual precipitation is 50 inches per year.

An outcropping of an impervious shale stratum affords an excellent foundation for the dam. To make the necessary tests and visual inspection of the foundation material, a system of 3-inch bortz drill holes and 36-inch calyx drill holes were drilled. The stratigraphic thickness of the rock formation at the dam site is about 725 feet.

The great height and length of the earth embankments make the design of these features assume unusual importance in order to assure absolute safety. A cross section of the dam shows the earth embankments are constructed with an impervious center core of rolled clay fill, supported by free draining shells of quarry rock (Knox dolomite) available near the site of the dam. Rock fill is dumped into place to form a 20-foot top, and side slopes of 2 on 1. On the upstream side of the dam, sand filter and a layer of crusher run rock is placed between the impervious core and the quarry rock. Where required by topography, sand drain blankets and drain pipes are placed on the downstream side of the embankment. A cut-off trench was excavated along the length of the embankments. It carries the dam into firm undisturbed shale.

The foundation treatment consists of curtain grouting along the cut-off trench under the rolled fill sections and curtain grouting and consolidation grouting under the concrete sections of the dam.

TVA had a complete, well equipped, soils laboratory set up at its Watts Bar project. Therefore, when Congress ordered the immediate construction of the Cherokee project, it was possible immediately to obtain samples of soil and to conduct the laboratory tests to establish the necessary data and curves for proper field control of the rolled fill operations. The availability of this laboratory and personnel made it possible to start the rolled fill construction operations of the Cherokee Dam promptly.

Clay Fill Carefully Studied

Material used in the rolled fill operation is a red chert bearing clay. Soil samples were obtained, and tests were made for compaction, permeability, and sheer, using both the direct shear machine and the triaxial testing machine. From these tests, field control data and curves were developed. This careful analysis of

(Continued on page 248)

Stripping Pennsylvania A

Five draglines steal the show on two coal stripping contracts held by Carey, Baxter & Kennedy, Inc. Here is an on-the-job description of their operations

THE ELLANGOWAN and Boston Run strippings that Carey, Baxter & Kennedy, Inc., are operating for Philadelphia & Reading Coal & Iron Company near Shenandoah and Mahanoy City, Pennsylvania, are excellent examples of the way draglines have superseded other types of excavating equipment in this highly specialized kind of work.

For more than a hundred years men have been trying to develop greater economy in the extraction of anthracite coal by the removal of overburden. Hand shoveling, drag scrapers pulled by yokes of oxen, buckets raised by horsepowered derricks, power shovels, aerial tramways — all these and more have been tried. Then came the draglines and the coal stripping contractors had the answer.

Strip mining anthracite coal, particularly in the middle and southern fields of Pennsylvania, is a very different proposition from bituminous coal stripping or any other form of open pit mining. In the middle and southern anthracite fields the coal veins to be strip-mined are practically never level, seldom synclines or anticlines, but almost always have a pitch that varies from 20° to verticality. Usually these veins are outcrops, although the coal stripper sometimes has to dig down through many feet of earth before he reaches the point where the coal is visible between the sloping layers of sedimentary rock.

Then the problem is to remove the overburden of earth and rock from the upper surface of the inclined vein of coal to permit the extraction of the greatest volume of coal possible, so that the total value of the coal will insure a fair profit after the total cost of the entire operation is deducted.

C. B. & K. Stripping Contracts

It is the usual practice in the anthracite regions to let the removal of overburden and the extraction of the coal to stripping contractors who are nearly always

• Swinging a 3-yard bucket on a 70-foot boom, this Bucyrus-Erie dragline casts earth and rock overburden at the Philadelphia & Reading Coal & Iron Company's Boston Run mine.

Anthracite

better organized and equipped for this work than the coal companies.

At the Ellangowan and Boston Run strippings, from which Carey, Baxter & Kennedy, Inc., have contracted to remove coal for the Philadelphia & Reading Coal & Iron Company, the pitch of the veins varies from 30° to 40°, with occasional places where the coal is actually perpendicular for short distances. At Boston Run the bottom split of the Mammoth vein is being stripped, while at Ellangowan the draglines are working on the top, middle and bottom splits of the same vein.

Let's take a look, first, at the Ellangowan strippings. This operation is divided by a public highway into two sections, and is on the northerly slope of a big syncline or "basin" where the outcrops through the layers of rock are covered with 10 to 30 feet of earth overburden. Due to the pitch of the vein, the top of the "top split" is about 80 feet below the surface of the earth at the deepest part of the excavation. The total thickness of the three splits of the Mammoth vein, plus the two layers of "divider" slate which separate the three splits, is in the neighborhood of 30 feet.

• Maintenance headquarters for the C B & K equipment is this group of buildings that house the garage, machine shop, welding shop, and blacksmith shop.

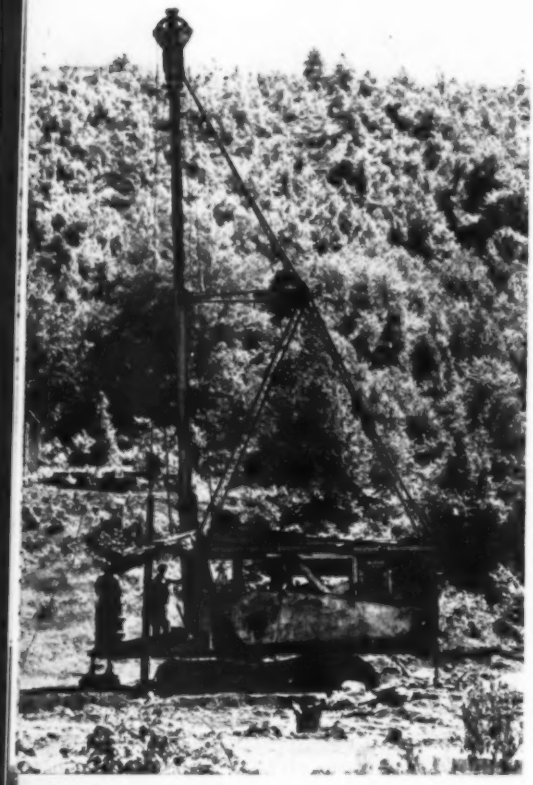
• Nine yards of rock and dirt hit the spoil pile as C B & K's Bucyrus-Monighan 10-W moves overburden at the Ellangowan strippings. (Philadelphia & Reading Coal & Iron Company Photo.)

Overburden at Ellangowan is about 30% earth and 70% rock, mostly sandstone, with some conglomerate. A stratum of shale, varying in thickness from 4 to 10 feet, is usually found resting directly on top of the coal vein. The total surface area involved in the Ellangowan strippings is 3,600 feet long by 700 feet wide.

Since the thickness of coal veins in this region is reasonably constant for any given operation, and since the veins are rather steeply pitched. The "V"-shaped excavations to remove overburden increase in yardage the deeper they have to go to reach the coal, although the amount of coal that can be extracted is practically the same, no matter how thick the overburden. This ratio between yardage of overburden and long tons (2,240 lbs.) of coal removed varies in a stripping contract as a whole, from 2 to 1 to 5 to 1. At Ellangowan the ratio is probably about 3½ to 1.

A deep stripping, such as Ellangowan, would involve so much terracing and rehandling if shovels were used to remove overburden that the "ratio" and costs would be increased to an unprofitable point. In order to make deep strippings profitable, Carey, Baxter & Kennedy, Inc., were the first

• Left: Coal at the Ellangowan mine is loaded to double - spotted Mack trucks by a Bucyrus-Erie 2½-yard dragline. Note size of the material being handled.



to introduce large dragline equipment in the anthracite fields, entirely eliminating terracing and the truck-hauling of overburden.

Dragline Output

About 7 years ago they purchased a 10-W Bucyrus-Monighan diesel-powered dragline with a 140-foot boom and a 10-yard bucket . . . the biggest dragline in the anthracite regions. The boom was recently lengthened to 175 feet and a 9-yard bucket swung from it, this is the machine that does the heavy digging at Ellangowan.

Operated three 7-hour shifts per day, it casts as many as 212,000 cubic yards per month and seldom less than 100,000 cubic yards per month, even in the meanest kind of work in rock.

The 10-W is used only for casting overburden to spoil banks and there is plenty of this to do at Ellangowan, for the contract involves the removal of approximately 1,550,000 cubic yards of earth and rock.

The first step in stripping at Ellangowan is, of course, the casting of earth overburden, after which a 29-T Bucyrus-Erie blasthole drill bangs down holes 35 to 70 feet deep with a starting diameter of 9¼ inches and a bottom diameter of 8¾ inches. At 58 to 60 strokes per minute, the footage average 33 feet per day, about 30% faster through the badly seamed rock than the 6-inch bits formerly used.

Blast holes are staggered 9 feet from the working face and 15 to 18 feet from each other for some shots at Ellangowan, but customarily only one row of holes is shot, 9 feet back from the working face and 15 feet apart. The first move in loading is to thread Primacord through the bottom 5½-inch x 20-inch cartridge of 60% Hercules gelatin and lower it to the bottom of the hole with a rope and a self-freeing hook, after which 4 to 6 more cartridges of 60% are placed. Then follow alternate fillings of "black dirt" stemming and 40% gelatin to within 20 or 25 feet of the surface of the ground. Loads vary because of varying depths and rock conditions, but about ½ pound of explosive is used to bring down each cubic yard of rock. Ordinarily eight or ten holes are shot at once. Little secondary blasting of rock overburden is required, although occasionally a little air hammer work is done. An important requirement in the blasting of rock overburden is that the coal be shattered as little as possible, as big chunks of coal are worth more than coal dust.

The blasting of the coal is a separate operation, done with Ingersoll-Rand Jackhammers equipped to drill 1¼-inch blast holes in the "divider" slate between the "splits" of the vein. Light charges of 40% gelatine are used in these holes, the object being only to loosen the coal so it can be loaded out. This requires about ⅗ pounds of gelatine per cubic yard of coal. Air for the Jackhammers as supplied by an Ingersoll-Rand compressor.

Exposed coal is loaded out into Mack trucks by a 52-B diesel-powered Bucyrus-Erie dragline with a 60-foot boom and a 3½-yard bucket in one section of the

• Left, above: Nine inch blast holes are placed by the Bucyrus - Erie 42-T preparatory to breaking up Boston Run overburden. Left: This small preliminary breaker and stone-removing plant handles material from the Ellangowan strippings.

Ellangowan strippings, while in the other section other Mack trucks are filled by a 43-B Bucyrus-Erie gasoline-powered shovel with a 1¾-yard dipper. The 52-B dragline, working on an 80-foot lift, handles 900 tons of coal in a 7-hour shift; the 43-B shovel, at the bottom of a long ramp, handles 1,000 tons per shift. The average haul for the trucks is 3,800 feet to a small breaker where the greater portion of the rock and slate is removed from the coal, which is then loaded into hopper bottom freight cars and railroaded down to the Philadelphia & Reading Coal & Iron Company's St. Nicholas breaker (the largest in the world) for manufacture into prepared and steam sizes.

Boston Run Operations

Operations at the Boston Run strippings, about 4 miles from Ellangowan, are basically the same. The tract is 2,200 feet long by 900 feet wide. Total overburden is about 975,000 cubic yards, of which probably 55% is rock and the balance earth. Depth of excavation is about the same in both operations. Expected recovery of coal is 310,000 long tons, making the "ratio" a little over 3%.

Earth overburden is not stripped before drilling blast holes at Boston Run. A 42-T Bucyrus-Erie blasthole drill puts down 9¼-inch to 8¾-inch holes to depths of 35 to 70 feet below the surface, 9 feet back from the working face and staggered on 15 to 18-foot centers.

Loading is similar to Ellangowan, but slightly heavier, and as many as 30 holes are shot at one time, 7/10 pound of explosive being used to loosen 1 yard of rock. Weight of rock in both operations is between 150 and 160 pounds per cubic foot in the solid.

Casting of earth and rock overburden is done with a 3-W Bucyrus-Monighan diesel-powered dragline with a 2½-yard bucket swinging from an 80-foot boom. In 66 shifts of 7 hours each, this dragline casts 30,000 cubic yards.

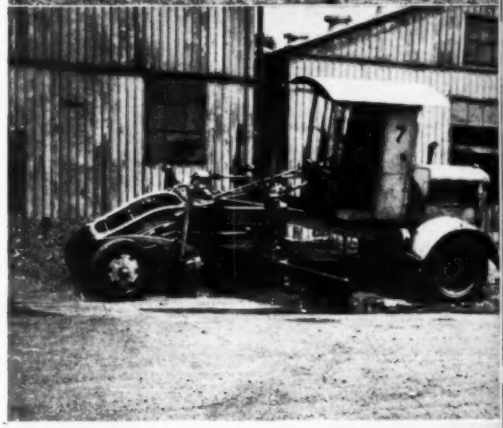
The 3-W dragline is assisted in the casting by a 55-B Bucyrus-Erie diesel-powered dragline which has a 70-foot boom and a 3-yard bucket, and a 52-B Bucyrus-Erie diesel-powered dragline with a 70-foot boom and a 2½-yard bucket. The 55-B dragline casts 530 yards per 7-hour shift and the 52-B casts 450 yards in the same time.

Coal is loosened at Boston Run in much the same way as at Ellangowan, and is loaded out with the 55-B dragline into Mack trucks, of which Carey, Baxter & Kennedy, Inc., own and operate a fleet of 31. Truck haul at Boston Run is 2.3 miles to a small breaker. The 52-B dragline also loads out coal on occasion, handling 750 long tons as compared with the 55-B's 900 long tons per 7-hour shift. The coal weighs 65 to 75 pounds per cubic foot in the loose, including the small amount of rock and slate which adheres to it, or is mixed with it.

Carey, Baxter & Kennedy, Inc., has built some 15 miles of sidehill road in its many stripping operations during the past years, most of it extra wide to permit the moving of the draglines from one stripping to another. For this purpose the 43-B shovel and two

(Continued on page 244)

• Right: C B & K field office men pose for the author's camera. (L to R) Stewart Giffin, timekeeper; Allan E. Coddington, engineer; James H. Scofield, superintendent; Ralph Havard, chief clerk; and William E. Conroy, vice-president. Below: A Caterpillar - La - Plant - Choate unit grades a Boston Run hauling road.



• Right, above: This Caterpillar Auto Patrol keeps C B & K hauling roads shipshape. Right: Exposed coal at the Ellangowan mine is loaded out to a Mack truck by a Bucyrus-Erie 1¾-yard shovel.

EXCAVATING ENGINEER

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Grand Coulee Goes to Work

Grand Coulee Dam, the greatest structure man has made on earth, went to work at noon, March 22, 1941. (See Excavating Engineer, August, 1936 and March, 1941 for feature articles on this project.)

Called to the colors two years ahead of schedule by vital defense demands for power, the giant's initial task is the production of electrical energy to spark the arsenal of democracy.

With simple ceremony, Grand Coulee started operating the gates in the plug it has put in the Columbia River, and water which had been arrested by the dam in its 1,300-foot plunge downward to the sea started whirling the first generators installed. This initial surge of power will be augmented in midsummer as more generation capacity is added, and it will be augmented thereafter until an amount approximately equal to 1/12 of the total power today generated in this nation pours from these mighty machines into a network feeding industries, farms, and homes of the Pacific Northwest.

Meanwhile engineering and planning of the irrigation features of the great project proceed towards making 1,200,000 acres of desert bloom into an oasis the size of Delaware. People of today and their grandchildren, and their unknown descendants beyond them can seek economic sanctuary in this oasis, which will be a fertile land of steady climate and controlled water and power.

A dream of half a century, a plan of a score of years, and a labor of some one hundred months resulted in achievement when the continent's second river leaned into the harness men have fashioned and started pulling with a force eventually to be measured as 2,700,000 horsepower. This will be the largest single source of energy on this planet, the largest by so wide a margin that the 1,835,000 horsepower of second place Boulder Dam seems dwarfed.

In less than eight years whole roomsful of blueprints have been translated with steel and concrete into a cleanly symmetrical, strongly beautiful structure that will epitomize the contractors and engineers of our generation in the distant years to come. Started as an economic defense project, Grand Coulee now takes an important position in the front line of our national defense.

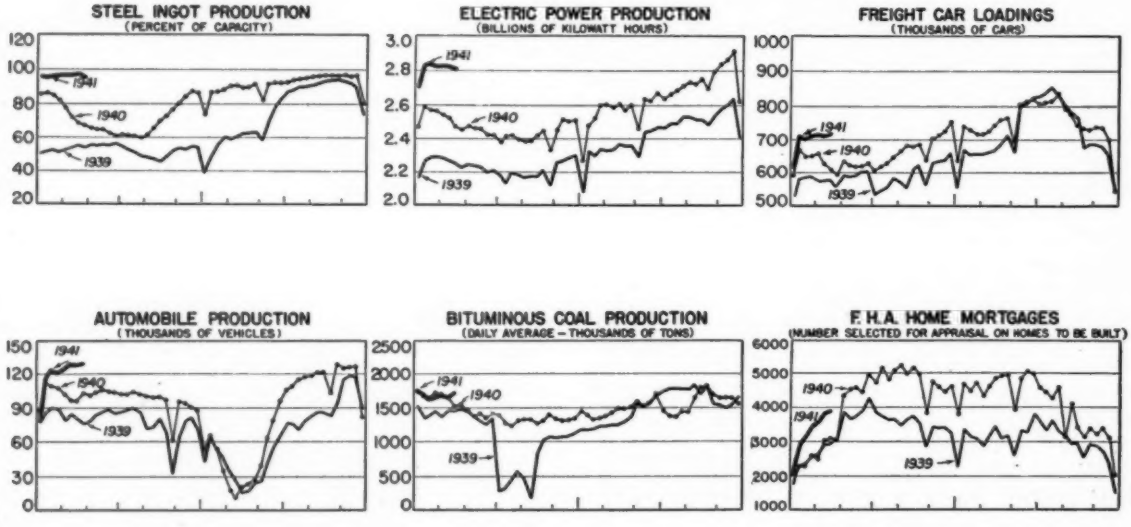
Construction Rise Continues

Construction in the 37 states east of the Rocky Mountains continued at a high level of activity during January. The total valuation of contracts awarded, the best January figure since 1930, amounted to $305,205,000, 55 per cent greater than the January 1940 total.

In January, 1941, the dollar volume of commercial building was $26,944,000 compared with $15,924,000 in January, 1940, and manufacturing building was $55,948,000 compared with $12,865,000. At the same time, small home building continued to be quite active. January valuation of contracts awarded for the construction of one- and two-family dwellings was 76 per cent larger than during January, 1940.

It is likely that the pace of private capital investment in building has been accelerated by demands outgrowing from the defense program. The noticeable increase in activity in commercial and manufacturing buildings, however, is not only ascribable to this factor, but also probably to anticipation of an upsurge this year in the demand for consumer

MONTHLY BUSINESS INDICATORS



goods which will be created by the additional income as a result of increased industrial production.

Diversion Forces New York to Finance Highway Construction

The bitter fruits of highway fund diversion have reached the harvest point in New York State, where a final report by the State Highway Survey Committee informed the state legislature February 27 that diversion of automotive tax revenues to unrelated uses has resulted in state highway construction and maintenance neglect to such an extent that only major bond issuance could now provide sufficient funds to even partially meet rehabilitation needs.

The committee, a joint legislative study group created last year and headed by Senator William H. Hampton, Utica Republican, made no specific recommendations as to the size of its contemplated bond issue, but it was indicated a $400,000,000 figure had been discussed. The report made it plain that, in the opinion of the committee members, not even that figure would be enough to do everything that should be done for highways in the state.

Terming the state's road situation worse than five years ago, the report stated:

"The time has arrived to face the facts. Inadequate appropriations year after year, necessitating deferment of essential construction and reconstruction projects, have taken their toll.

"If the proceeds from a 2-cent fuel tax, and the license plate tax which was levied for highways had been used for highways and the major part not diverted to other purposes, there would be a far less serious highway problem today."

An adequate highway program over a reasonable period of time, the report estimated, would cost about $110,000,000 a year, or $63,000,000 more than the budget amount proposed for the coming year.

"Regardless of the necessity and desirability," it was stated, "the committee is not at all sure that under any plan of financing during the next few years as much as $110,000,000 a year can be devoted to highways.

"One cent of the motor fuel tax now produces about $17,000,000 a year. If, for example, the present proceeds of two cents of motor fuel tax were impounded for 15 years it would more than finance a $400,000,000 bond issue, which could be made available at the rate of $40,000,000 a year over a 10-year period.

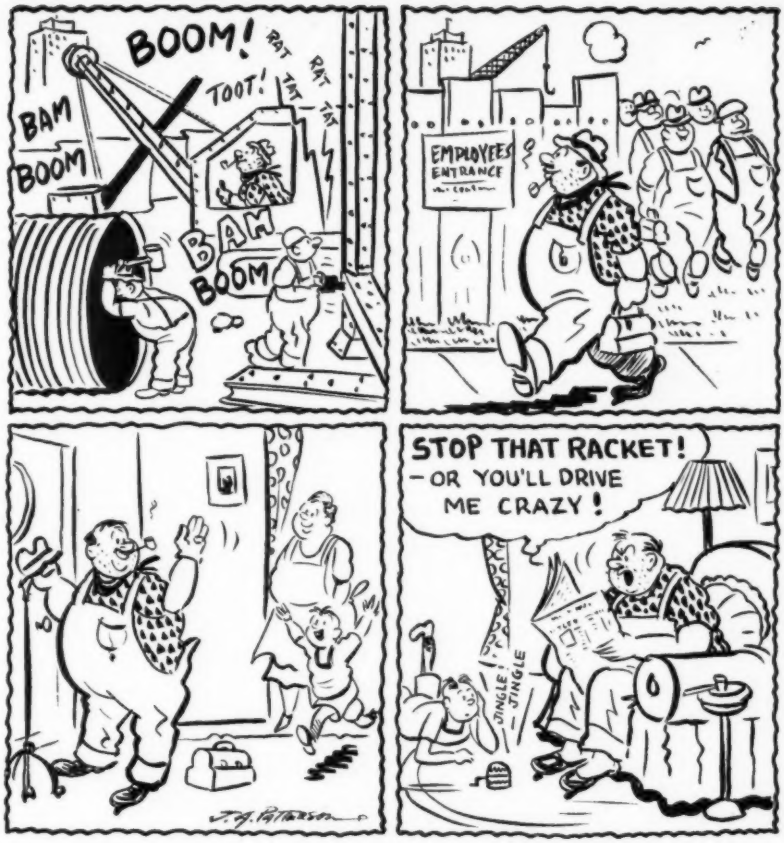
"The entire issue would be retired in 15 years. This amount, properly allocated and supplementing regular budget appropriations and Federal aid, would make it possible to rehabilitate our state highway system.

"This committee concludes that under the present circumstances the only way by which funds in sufficient amount to meet the needs can be secured is by the issuance of bonds."

The report gave new emphasis to the fact that gasoline taxes have not been reserved for highway construction, as was originally intended, but have been diverted, for the most part, into the general fund. Wholesale diversion has become such a perennial custom in New York State that any earmarking now of the gasoline taxes would necessitate the finding of some new taxes to replace the revenues that would be lost to the general fund.

"Abundant evidence has been given this committee," the report commented, "to show there is a rapidly growing resentment on the part of motorists in having this money diverted.

"The time is fast approaching when something must be done to remedy this situation. Either use the money for highways or say to the motorist that as a class they must pay a special and additional tax for the support of government."



Rush Trans-Canada Road

Immediate completion of the Trans-Canada Highway is being carried on as an urgent defense measure. Plans based on aerial surveys have been made and contracts let for the last 153-mile gap between Hearst and Geraldton, Ontario. Some of the preliminary work had been done by prison labor at the western end, but the remainder is being built under fifteen contracts, at a total cost of six million dollars. It is expected the road will be opened to traffic late this fall.—*Highway*

Equipment you ought to KNOW ABOUT

For further details about the equipment on this page please write to the manufacturer, mentioning Excavating Engineer.

Super "C" Tournapull

Manufacturer: R. G. LeTourneau, Inc., Peoria, Illinois.

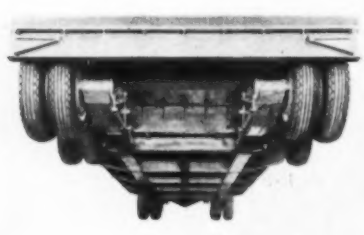
Claims: Designed to meet the construction needs of larger, long haul earthmoving jobs. Powered by either a 130 or 150 h.p. 6-cylinder engine. This extra power is

utilized to increase the production by pulling a model LP Carryall with a struck capacity of 12.1 and a heaped of 15 cu. yds. Can attain high-gear hauling speed up to 15 m.p.h., spread the load while moving, and continue back to the cut in one continuous operating cycle. Interchangeable with the model LP Carryall is the W-10 Tournatrailer with a struck capacity of 9.5 cu. yds., and a heaped of 12. Tournapull loads are expelled by positive, mechanical ejection. Standard equipment includes hydraulic brakes on both the Tournapull and Carryall, front crankcase guard with pull hook, front bumper, electric lights, starter, horn and cab.

"T" Rocking Beam trailer

Manufacturer: Rogers Bros. Corporation, Orchard Street, Albion, Pennsylvania.

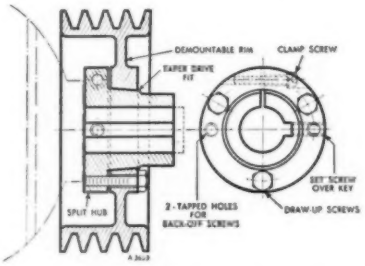
Claims: Welded box section which rocks lengthwise of the frame is attached to each side at the rear. At either end of each section is a short, non-tapering axle which carries a wheel on two



heavy-duty Timken bearings. This axle is cambered to fit the normal crown of the road. These trailers are popular in states wherein the allowable load is based on the number of different axle planes. In these states type "H" trailers, with four wheels in line, are regarded as single axle rear trailers but type "T" trailers are rated as two axle rear trailers and are therefore acceptable. The design of these type "T" trailers also permits building units only 8 feet wide in capacities from 15 to 35 tons, whereas the cross-sections of tires restricts standard type "H" trailers of this width to 25 tons.

V-belt driver sheaves

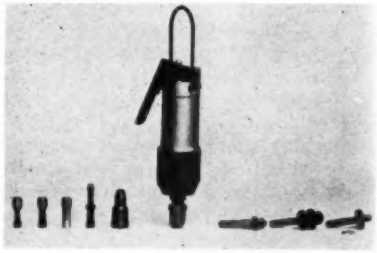
Manufacturer: Worthington Pump and Machinery Corporation, Harrison, New Jersey.



Claims: Simplicity of construction and suitability for any application where quick mounting of sheave to shaft, and dismounting from shaft, are desirable. In general maintenance it eliminates the necessity of a wheel puller to remove wheel or hub from shaft to get at driving unit. Each sheave unit consists of two parts, the hub which is clamped to the shaft by means of a cap screw in its flange and fastened by a standard keyway, and the rim which is taper-fitted to the hub and is fastened with three draw bolts. No pounding or prying required to remove either the rim or hub. Available in the complete range of standard driver sizes.

"Multi-Vane" grinder

Manufacturer: Ingersoll-Rand Company, 11 Broadway, New York, New York.

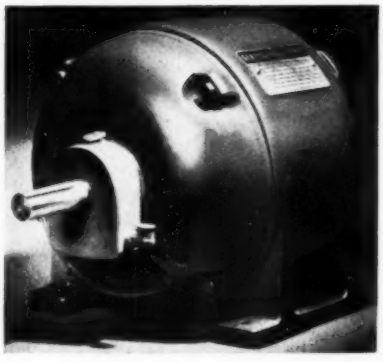


Claims: Weighs only 1¼ lbs. and operates at 20,000 r.p.m. at 90 lbs. pressure. Built to take 1½" diameter organic bonded or 1¼" diameter vitrified wheels. Various sizes of collets to take the mandrel mounted grinding wheels or small twist drills, also available. Used for innumerable light grinding jobs wherever metal must be removed from "hard to reach" places.

G-E polyphase motor

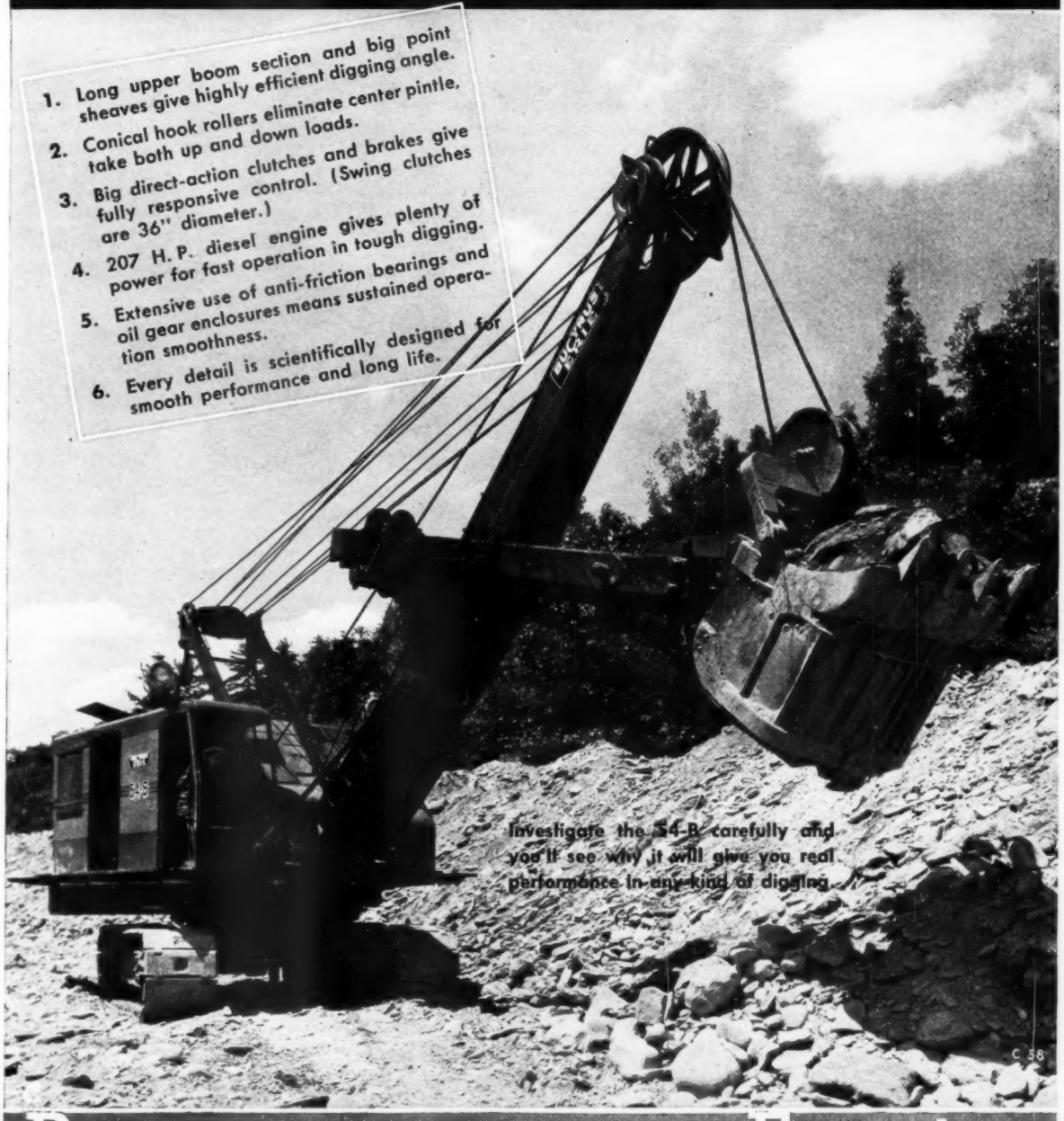
Manufacturer: General Electric Company, Schenectady, New York.

Claims: Known as Tri-Clad motor. Represents one of the most extensive product changes in the history of the company. Featuring modern streamline style, and a



Check these output-producing features against any 2½-yard excavator

1. Long upper boom section and big point sheaves give highly efficient digging angle.
2. Conical hook rollers eliminate center pintle. take both up and down loads.
3. Big direct-action clutches and brakes give fully responsive control. (Swing clutches are 36" diameter.)
4. 207 H. P. diesel engine gives plenty of power for fast operation in tough digging.
5. Extensive use of anti-friction bearings and oil gear enclosures means sustained operation smoothness.
6. Every detail is scientifically designed for smooth performance and long life.



Bucyrus·Erie

SOUTH MILWAUKEE, WISCONSIN

For your convenience in writing to Bucyrus-Erie Co., you will find a card bound in this issue.

more complete protection assured through the use of cast-iron frame. Major advances in the insulation of current-carrying parts. Improved bearing design and lubricating arrangements. Cast-aluminum rotor, pressure-relief system of greasing for ball-bearing motors. Better electrical protection made possible by the use of Formex, a new type of magnet wire, operating wear and tear lessened through the use of a new design of sleeve bearing.

Caterpillar Dump Wagon

Manufacturer: Caterpillar Tractor Company, Peoria, Illinois.

Claims: Powered by a 90 h.p. diesel engine, capable of hauling more than 13 tons of earth at 18

miles an hour. Placed on the market after more than three years of intensive development work and field tests. Built specifically for use on roadbuilding and construction projects where speed, long hauls and other physical conditions are favorable to rubber tires. Powered by the D468 "Caterpillar" diesel six-cylinder, water cooled automotive engine. Weighs 14,500 pounds, and has a tractive effort of 13,000 pounds in low gear, with a loaded wagon or scraper. Constant mesh type transmission with five forward speeds, ranging from 2.4 to 18 m.p.h.; and one reverse speed of 3 m.p.h. "High traction" differential which gives increased pulling ability. Finger-tip steering through a hydraulic booster arrangement requires steering effort of only one pound at the rim of the 20" wheel. An 11 cubic yard heaped measure, bottom dump, pneumatic tired wagon has also been designed and built by "Caterpillar" to go with the new tractor.

Essolube HD lubricant

Manufacturer: Standard Oil Company, New Jersey.

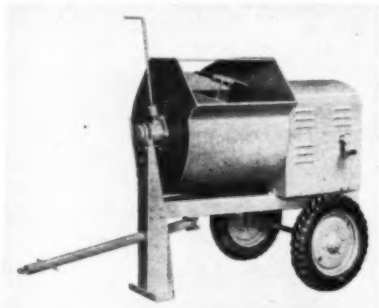
Claims: Developed to overcome piston varnishing, ring sticking and other major lubrication troubles which have limited output of many heavy-duty, high-speed diesel and gasoline engines. Has a viscosity index of approximately 100. In addition to inherently natural resistance to oxidation and high temperature, an exceptionally high ability to work out sludge deposits, protect bearings from corrosion and to prevent large deposits of varnish on pistons, valve stems, rings and other engine parts. It also has a valuable rust preventive action. Has been thoroughly tested and passed both the Caterpillar and General Motors engine test requirements.

For further details about the equipment on this page please write to the manufacturer, mentioning Excavating Engineer.

Rex mortar and plaster mixer

Manufacturer: Chain Belt Company, 1600 West Bruce Street, Milwaukee, Wisconsin.

Claims: Six cubic foot capacity. Adjustable steel scraper blades make certain a clean drum after every discharge. When wear occurs the scraper can be set to clean drum sides as easily as when the machine was new—no wastage. One cylinder 4 H.P. gasoline engine is air cooled for lighter weight and easier operation. No radiator to damage, no water pump to cause trouble and no cylinder block to freeze in cold weather. Paddle shaft seal has a finely ground-surfaced collar re-

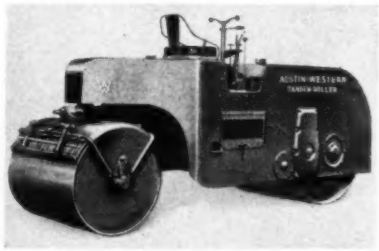


volving in contact with a Neoprene ring which is backed by a chamber packed with grease under pressure. Dirt and grout cannot get into the paddle shaft bearings. Drum lock is fool-proof, mixer can be towed easily because of its automotive cantilever type springs, has a protective engine and gear box covering, constricted discharge lip to prevent undue splashing, low shoveling height saves time and back-work. Also has the criss-cross and end-to-end mixing action and the short length, deep diameter drum found on previous Rex machines.

Tandem rollers

Manufacturer: The Austin-Western Road Machinery Company, Aurora, Illinois.

Claims: Built for general rolling use and precision work. Includes a number of improvements and refinements in design to obtain smooth and steady performance. Weights of the front and rear rolls can be increased by adding water to meet a wide variation of roller requirements



ranging from 133 to 301 lbs. per lineal inch. Operating advantages of these two new units include: better visibility to see close curbs; more convenient controls, with reversing clutch lever mounted on steering column; effortless hydraulic steer; lower center of gravity to prevent sway; less frame over-hang; more ground clearance under side plates; more stability; balance of engine and final drive parts to provide uniform weight distribution across the entire rear roll and good accessibility for reaching or servicing moving parts, hydraulic pump, strainer, etc. Mechanical features include: All welded, two-piece front rolls and rear roll of which are mounted on anti-friction bearings; front fork with horizontal king pin mounted on widely-spaced bearings and large diameter, vertical kingpost mounted in Timken bearings; gasoline or diesel power; two-speed forward and two-speed reverse type transmission with heat-treated, alloy steel gears and shafts and anti-friction bearings throughout; a master clutch between engine and transmission, controlled by foot pedal, and two, double-disc reversing clutches.

America DIGS IN

WHEN America decided to dig in, her first demand was for cantonments, enlarged factory capacities, airports and air and naval repair bases. Without these fundamental things she could not train her men, build their weapons or sustain her new power.

A dirt-moving job, this all-important preliminary work for the defense of this country. An emergency call for rock-busting, volume-boosting, dirt-moving power and for men to wield that power against time and weather!

"Caterpillar" Diesel power in tractors, engines and road machinery, which was already at work building those things worth fighting for, was ready to create the means with which they could be protected. And while most of the nation groans under an overload, these machines and the men that own them are pitching in on basic defense projects without breaking their stride.

The yardage being moved in this country today would be looked upon as a miracle in any other country in the world. America is really digging in . . . and digging with the tools which have made her famous and which will assure her continued security.

The extension of the defense program places heavy demands on the men in the dirt-moving industry and on the manufacturers who furnish them with the tools for this necessary work . . . big things have been done, big things have yet to be done.

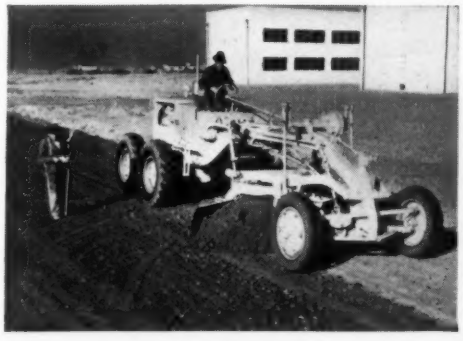
CATERPILLAR TRACTOR CO., PEORIA, ILL.

(ABOVE) • *Whipping winter's worst conditions to expand the Glenn L. Martin Company's plane plant.*

(AT RIGHT) • *Huge scraper-units hasten the building of California's Camp Callan.*

(LOWER LEFT) • *This machine will give an air station fast roads, smooth runways.*

(LOWER RIGHT) • *Jack-hammers powder rock as "Caterpillar" Diesel Engines drive compressors.*



CATERPILLAR *Diesel*

REG. U.S. PAT. OFF.

ENGINES AND ELECTRIC SETS • TRACK-TYPE TRACTORS • ROAD MACHINERY

Field NOTES

"In the Course of Employment"

Because comfort stations are not always a part of the equipment used on excavating jobs, particularly where there is nearby timber or objects that provide a screen, the decision reached by the Iowa Supreme Court in a recent case has at least some practical importance.

The plaintiff, Sachleben, was working on a sewer job when an urgent call of nature led him to a railroad yard several hundred feet away, for lack of closer toilet facilities. While answering the call near some railway cars, they were suddenly moved and he was seriously injured.

This legal question was checked up to the Supreme Court for decision: Did this accident arise out of and in the course of Sachleben's employment? If so, he was entitled to an award under the Iowa Workmen's Compensation Act; otherwise he had no claim against any one on account of the accident. Six of the nine judges of the court swung the decision in favor of the injured man. They said: "The rule is that an injury is one arising out of and in the course of the employment which occurs while the employee is doing what a man so employed may reasonably do within the time during which he is employed, and at a place where he may be during that time." (Sachleben v. Gjellafeld Construction Company, 290 N. W. 48.)

The decision suggests at least one good reason why employers should provide reasonably convenient toilet facilities for use by their workers.

—Arthur L. H. Street, Attorney-at-Law.

• In digging a tunnel on the Gila Valley irrigation project, in Arizona, numerous oversize boulders led the contractors to raise the head of this Conway mucker 13 inches, by inserting steel blocking on each side, thus eliminating much trouble, in mucking out.

Cork Drill Socket Holders

The usual assortment of drill sockets used continually around the temporary repair shop and machinery can be conveniently kept in place as shown in the accompanying illustration.

A number of ordinary bottle corks tacked down with a fairly heavy nail at some handy place around the press or bench will save many minutes of hunting for the right socket. The opening in the socket should fit snugly over the small end of the cork about half way down, and only a light pressure will make the socket stand rigidly upright.

• Keep your drill sockets from rolling around and disappearing with a row of ordinary bottle cork holding posts.

A drop or two of oil can be put on the cork to prevent them from wearing too rapidly.

—Frank Bentley

Dynamite Solves Unusual Pile Extraction Problem

In San Diego Harbor, California, where the blue Pacific Ocean laps eternally at the sandy shore, one of the most unusual piling extraction problems ever to present itself was solved successfully recently. The extraction of these piles, which pulled a contractor out of a tough spot, was described in the February, 1940 issue of "Explosives Engineer" by A. McQ. Williams, of the Hercules Powder Company staff.

The contract, let by the U. S. Navy Department, called for the extraction of some 150 reinforced concrete tongue and groove piles in San Diego Bay. These piles, forming a sea wall at one part of the Navy airplane base on North Island, were 25 feet long, 8 inches by 12 inches thick, and were driven to a penetration of 15 feet into the sand. The contract called for the removal of the piles without damage; a provision which was made in order to re-drive the piles on other Navy work. On the face of only 15 feet of penetration into sand, one would be led to believe

Speeding back and forth between Chicago and Peoria—644 miles a day on a mile-a-minute schedule—

Rock Island Rocket #601 now *travels 150,000 miles between piston inspections.* Before using RPM DELO it was necessary to pull, inspect and clean pistons in the Rocket's 16-cylinder Electro Motive Diesel *at one-third this distance*—every 50,000 miles!

Cylinder wear has hit a record low of .0005" in 160,000 miles!

Piston rings now operate 180,000 miles between replacements—the best ring mileage Rock Island has ever had.

And valves last longer, too! RPM DELO has kept them working perfectly for over 400,000 miles.

Because it keeps *engines so clean* and lowers wear rate of all engine parts so much—RPM DELO has been chosen by Rock Island for 6 Rockets and most of its Caterpillar, Hamilton and Cummins Diesels used in passenger and switching service.

Aren't these reasons enough for trying it in your Diesel equipment? Do it now!

ORDER RPM DELO
Unequaled
FOR YOUR DIESELS

Approved by the makers of over 95% of the installed Diesel horsepower in America, RPM DELO is marketed under the following names:

RPM DELO
Diol RPM DELO
Kyso RPM DELO
Sohio RPM DELO
Signal RPM DELO
Imperial RPM DELO

Ask your Diesel engine manufacturer or distributor for the RPM DELO supplier in your locality.

RPM DELO
REG. TRADE-MARK
DIESEL ENGINE LUBRICATING OIL

STANDARD OIL COMPANY OF CALIFORNIA

For your convenience in writing to Standard Oil Company of California, you will find a card bound in this issue.

the extraction of the piles would not be so difficult. But wait.

The finished wall of piles had been gunited, and the concrete, forced against the wall under the pressure of gunite guns, had penetrated into the grooves of the joints and set, making a wall almost as solid as if finished reinforced concrete had been poured throughout. Add to that the fact that each pile was reinforced with six ¾-inch square steel bars, and the result was a structure so solid that a piledriver extracting by the straight pull method was only wasting time.

The big problem was to get one pile broken loose from the others and removed. Then, by applying a side strain, piles ranging alongside this "key pile" could each be broken loose and extracted in turn. But the key pile wouldn't give.

One of the most powerful piledrivers in the San Diego section was brought in and the load cable hooked on to each of at least a dozen piles. About all that happened was a sinking feeling as the load line pulled the forward deck awash, and a snap as the load line broke. When this happened several times, it became apparent to the contractor that this method would not do the job.

Someone suggested dynamite, and since there was nothing in the Navy specifications definitely prohibiting the use of explosives, the Navy Public Works Officer in charge of the work granted the contractor permission to try explosives on one pile.

Selecting as the key pile one that appeared to be a weak place in the wall, work was begun to jar this pile loose. All the accumulated sand was removed from the bay side of the wall with a water jet from the ocean floor to the bottom of the pile. This was done so the pile would have room to move outward when the blast was set off from the land side.

Thirty-three cartridges of 40% Hercules gelatine dynamite were tied to a 2" x 4" timber 25 feet long, and the timber with cartridges attached was jetted down vertically alongside the key pile. When the jetted dynamite was in place, the top of the charge was 6 feet below the ocean floor and the bottom of the charge was 14 feet below the bottom of the pile.

The open pit left under water over the dynamite was then filled with sand with the water jet. A strain was taken with the pile line, and the shot was fired. Wham! The pile sprung outward and upward, springing the groove loose on the bay side and loosening it so it could be removed. After this key pile was out the remainder of the piles were extracted without further difficulty.

—Floyd Suter Bixby

Finding Square Feet in a Cylinder

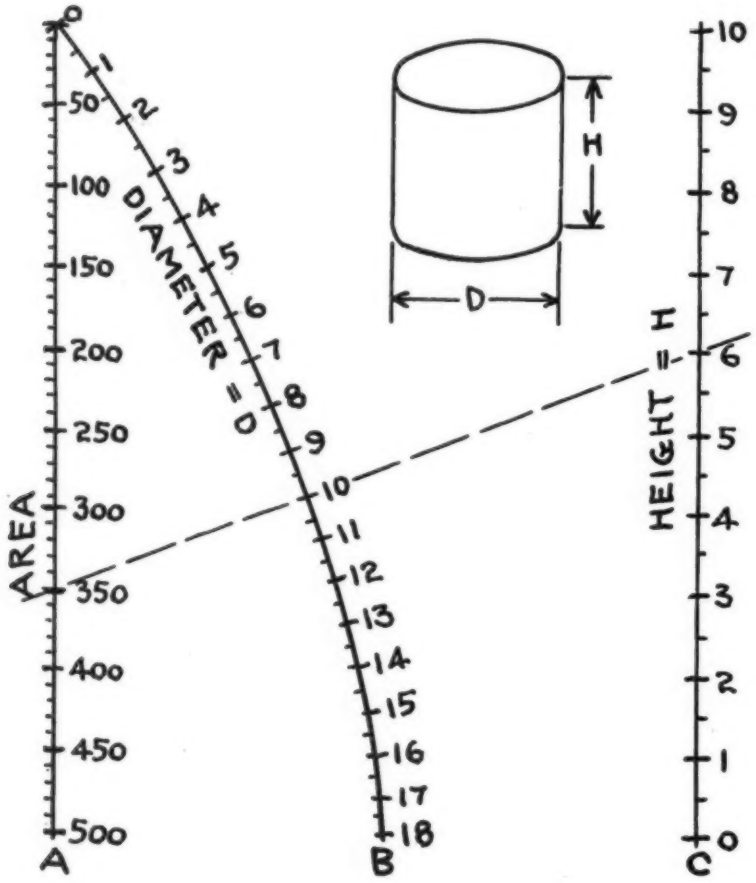
An easy, yet accurate method, of computing cylindrical areas is made possible by the accompanying chart. It will enable you to quickly estimate the total number of square feet, yards, or inches in any cylindrical structure of any diameter up to 18, and of any height. The chart automatically adds the two flat ends and the cylindrical surface without any "longhand" figuring whatever.

For example, if the diameter of a cylinder is 10 feet and the height is six feet, what is the total number of square feet?

The dotted line drawn across the accompanying chart shows how easily it is done. The line passes through the 10 in the curved column B, and through the six in column C. The intersection with column A shows that the answer is 350 square feet. Or, if the diameter and height are in yards, the area will be in square yards. And so on.

In the event that the height of the cylinder should be greater than given in column C, simply add the necessary length to column C and then proceed as above. Thus if the height is 20 feet and the diameter five feet, double the length of column C. Then, running a line through the 20, column C, and the five, column B, it will be found that the area, again, will be 350 square feet.

—W. F. Schaphorst, M. E.



• Computing the total square feet of a cylinder is easily and accurately done with this chart. Clip it for future reference.

LeTOURNEAU 'DOZER-CARRYALL HANDLING METHOD

"Tripled Production at Minimum Cost"

. . writes B. F. Gibson, esident superintendent f the American Zinc ompany's Mascot, ennessee, plant . . .

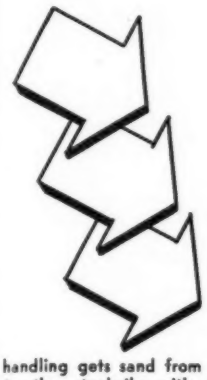
"We use LeTourneau equipment exclusively in our operation because we have found that since our establishment of a 'Dozer and Carryall system several years ago our production has tripled . . . and our cost in time, labor, maintenance and upkeep has been at an absolute minimum."

Dependable Performance in the Pinches

Mr. Gibson continues . . . "At one time, on a rush order for sand, two Carryalls and two 'Dozers loaded 110 sixty-ton railroad cars in 10 hours and maintained this production for a two-months' period!"

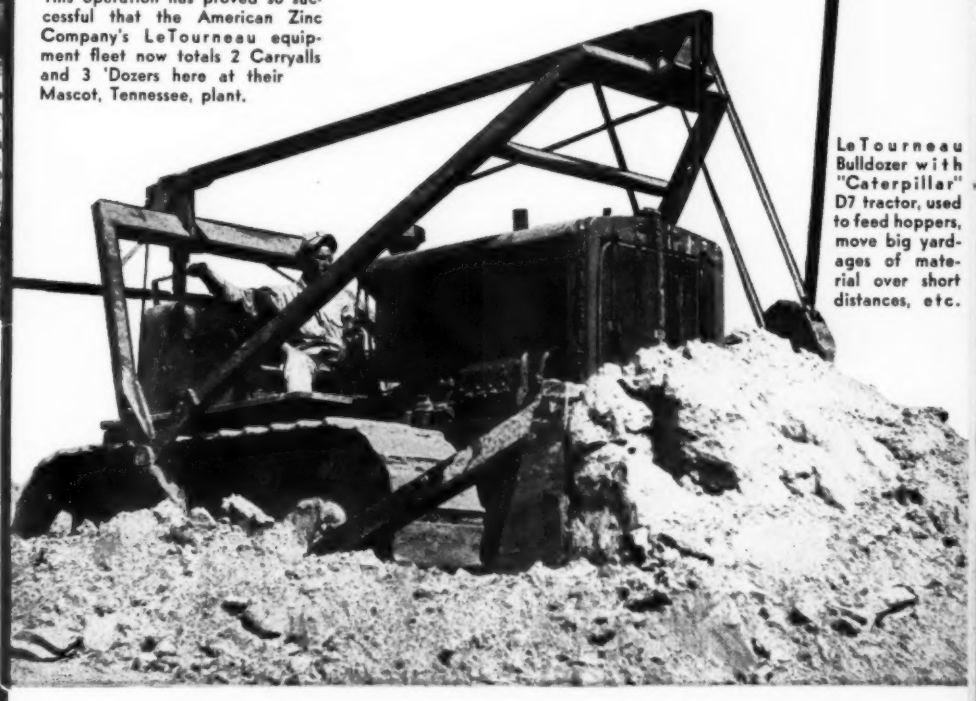
Fast, Low Cost Handling from Mill to Cars

Two 8-yard LeTourneau Carryall Scrapers, working behind "Caterpillar" D7 tractors, load the lime-stone sand (by-product of zinc mining) at the mill release area . . . carry and stockpile it at the storage area . . . all in one continuous operating cycle. From there, LeTourneau 'Dozers feed the sand and gravel, as it is needed, through a hopper onto a conveyor belt, which loads the freight cars.



he handling gets sand from the ill to the stockpile with this Tourneau Carryall self-loading, suling, -dumping rig. One man - the tractor operator — handles very Scraper operation. That cuts ndling costs . . . saves time . . speeds production.

This operation has proved so successful that the American Zinc Company's LeTourneau equipment fleet now totals 2 Carryalls and 3 'Dozers here at their Mascot, Tennessee, plant.



LeTourneau Bulldozer with "Caterpillar" D7 tractor, used to feed hoppers, move big yardages of material over short distances, etc.

Scores of Other Money-Saving Uses...

Like the American Zinc Company, and other leaders throughout the pit and quarry industry, you'll find LeTourneau equipment will provide a low-cost solution to your materials-handling problems. Clearing new pit areas . . . stripping overburden . . . stockpiling . . . building roads and dikes, etc. Best place to see how LeTourneau equipment can save you money is right on your own property. Call your LeTourneau-"Caterpillar" dealer for a demonstration . . . NOW!

R. G. LeTOURNEAU, INC.
Cable Address: "Bobletorno"

rryall* Scrapers, Angledozers*, Bulldozers, Root-*, Power Control Units, Drag Scrapers, Cranes, hdozers, Sheep's Foot Rollers, Tournapulls*, Tourna-llers*, Tournacranes. *Name Reg. U. S. Pat. Off.

LETOURNEAU

PEORIA, ILLINOIS • STOCKTON, CALIFORNIA

Shots from the FIRING LINE

AIMME Elects New Officers

John Robert Suman, vice-president of the Humble Oil and Refining Company, principal producing subsidiary of the Standard Oil Company of New Jersey, was inducted as president of the American Institute of Mining and Metallurgical Engineers at the annual dinner and honors night during its 154th annual meeting February 17-20 in New York City.

Other new officers, who also took office, are: vice presidents, Dr. Paul D. Merica, vice president of the International Nickel Company, and LeRoy Selsich, president of the Oliver Iron Mining Company, Duluth, Minnesota; directors, J. Terry Duce, Ira B. Joralemon, J. R. Van Pelt, Jr., and Clyde E. Williams.

Awards were presented as follows: The William Lawrence Saunders Gold Medal for distinguished achievement in mining to Herman C. Bellinger, vice president of the Chile Exploration Company of New York; the Anthony F. Lucas Gold Medal, posthumously to Conrad Schlumberger and his brother Marcel of Paris; the Charles F. Rand Memorial Gold Medal, to Robert Crooks Stanley, chairman of the board and president of the International Nickel Company; the Robert Woolston Hunt Awards for 1941, to A. B. Greninger and A. R. Troiana, respectively assistant professor of metallurgy at Harvard and assistant professor of metallurgy at Notre Dame, and to George E. Steudel, division superintendent of the Carnegie-Illinois Steel Corporation, Chicago, and the J. E. Johnson Jr. Cash prize award to Carl F. Hoffman, superintendent of blast furnaces of the Sparrows Point plant of the Bethlehem Steel Company.

Florida's Most Costly Road Is Officially Opened

By L. H. Houck

Florida's most costly road, the Hill Memorial Highway, or State Road 26 from South Bay through the heart of the Everglades to Fort Lauderdale, is scheduled to be officially opened on April 11.

All South Florida will welcome this new short cut through the wilds of the Everglades. The road has been under construction for more than three years and followed the course of the North New River Canal. It cost more than $2,000,000 and was built on a solid 15-foot foundation.

The first contracts were awarded to the George D. Auchter Company, of Jacksonville, and the Badgett Construction Company of Memphis, Tennessee, who moved in with their excavating machinery in 1937. (See Excavating Engineer, November and December, 1937)

• Equipped with a special grubbing blade, this International-mounted Bucyrus-Erie bullgrader clears land for a new railroad right-of-way in preparation for a relocation made necessary by the proposed flooding of the Grand Coulee Dam area. Porter Carter of Colville, Washington holds the 13½-mile land clearing contract.

The Auchter Company put three Bucyrus-Erie machines to work, a 37-B, a 45-B and a Bucyrus-Monighan 5-W Walker with a 100-foot boom and a 4½-yard Red Arch bucket, for the heavy work. The Badgett organization who were virtually holed up in the interior for more than six months, used two Bucyrus-Erie machines, a 43-B and 46-B.

Because of the extraordinary conditions brought about by the presence of soft black muck 15 to 20 feet deep, the building of this road was beset with many difficulties. Contractor Auchter invented a special dragline bucket for use in clearing the canal of hyacinths. It was a road of many firsts, and even with the opening continues to set-up new situations.

For instance, the state railway commission has granted a franchise to Mrs. M. M. Kettner, of the Glades Motor Lines, the only woman bus operator in Florida, to operate her buses from Palm Beach to Fort Myers and from Miami to Childs, via South Bay, Clewiston and Moore Haven.

North Atlantic Highway Officials Emphasize Defense

By Bethune Jones

Thomas C. Frame, chief engineer of the Pennsylvania Department of Highways, was elected president of the Association of Highway Officials of the North Atlantic States during its 17th annual convention, held February 19-21 in Boston, Massachusetts. He succeeds Vermont Highway Commissioner H. E. Sargent.

New Jersey Highway Commissioner E. Donald Sterner was elected vice president and A. Lee Grover, chief clerk and secretary of the New Jersey State Highway Department, was reelected secretary-treasurer. Massachusetts Public Works Commissioner Herman A. MacDonald and David Noonan of Albany, New York, assistant New York Highway Commissioner, were elected new directors. A. W. Brandt of Albany was elected an honorary director.

Directors reelected were Lucius D. Barrows of Augusta, Maine; F. E. Everett of Concord, New Hampshire; H. E. Sargent of Montpelier, Vermont; William J. Cox and Francis J. Whalen of Hartford, Connecticut; George E. Henderson of Providence, Rhode Island; R. B. Traver of Syracuse, New York; E. Donald Sterner of Belmar, New Jersey; James Logan of Mt. Holly, New Jersey; A. Lee Grover of Trenton, New Jersey; Thomas C. Frame of Harrisburg, Pennsylvania; W. W. Mack of Dover, Delaware; R. M. Reinhollar of Baltimore, Maryland; H. C. Whitehurst of Washington, D. C.; C. D. Buck of Dover, Delaware; and W. G. Sloan of Trenton, New Jersey. The latter two are honorary directors.

In one of the major addresses at the conclave, Charles Upham of Washington, engineer-director of the American Road Builders Association, expressed

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• Increased production of aircraft has necessitated the enlargement of the Glenn L. Martin Company plant at Essex, Maryland. In the foreground one of the Williams Construction Company's fleet of Caterpillar-Le Tourneau scraper units grades the site for the two new buildings that are to be erected.

the opinion that a minimum of $2,000,000,000 would now be spent on road construction if a universal, easily understood language were used by economists in discussions of economic matters.

Director Upham called for the expenditure of that sum of money each year, with federal assistance, towards a four-point combination national defense and economic program which would come to between $16,000,000,000 and $20,000,000,000 in 10 years. The projects would employ in the vicinity of 1,000,000 men, he estimated.

In his address on "The Economics of a National Highway Program," Mr. Upham emphasized that highways have been proven to not only render service to traffic but also to give such an impetus to the national economy in bringing new business that a return of more than three dollars is realized on every dollar spent.

The program urged by Mr. Upham would provide for the construction of some 3,000 miles of access roads to military areas, bringing up to military requirements of 14,000 miles of substandard roads in the country's large "strategic" system, improvement of more than 10,000 miles of tactical roads used by the Army and Navy, and the betterment of the large mileage, about 1,000,000 miles, of secondary roads serving as feeder roads to the main strategic system. Attention to inter-regional highway systems would come later, under the plan.

Criticising the high sounding phrases and expressions used in discussion of the nation's ill by economists, Director Upham declared that only a few engineers care to consider the relationship of economics to road building for that reason.

"They should strip economics of its high sounding terms and use understandable language," he declared, citing such expressions as withdrawal rewards," meaning wages, and "cyclical compensatory device," meaning ordinary government expenditure, as examples of difficulties placed in the way of engineers and others by economists. The language complexity used by economists, he asserted, impedes the solution of many of the nation's economic problems.

Retiring President Sargent was one of numerous speakers criticising the federal government for neglecting highway construction needs in its defense program.

"Billions of dollars," he declared, "have been legislated for increasing the armed forces, for the production of war materials, mechanized equipment and the extension of industrial plants, but none for financing access roads to plants and military establishments.

"No federal money, outside the regular federal aid, has been made available for the highways on which the country must depend for military transport. National defense is not local, but national, and it seems proper that the national government should provide for converting roads into necessary defense arteries."

Increased road appropriations were urged by virtually every speaker, with emphases placed on the importance of road construction from both the economic and defense viewpoints.

Central Valley Project Expenditures

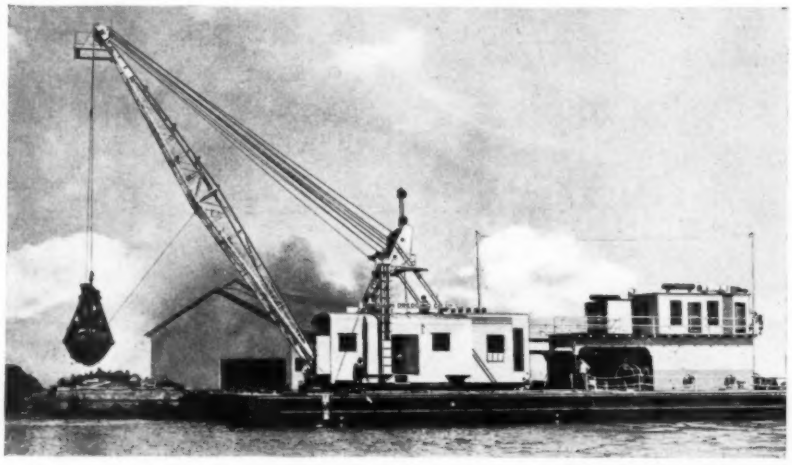
Almost 6,000,000 tons of cement, steel, machinery, sand, gravel, and other building materials, costing a total of $7,686,530, have gone into Central Valley Project structures so far, and expenditures for these supplies have been spread over 40 of the states, according to information released by the United States Bureau of Reclamation.

California, site of the project, has received about 50 per cent of the business, but seven of the ten states whose shares exceed $100,000 are east of the Mississippi River.

Purchases from middlewestern steel mills put Indiana in second place and Illinois in third, each with about $760,000 worth. Other states among the leaders are Colorado fourth at $625,000 and Oregon fifth at $452,000, followed in order by Pennsylvania, Alabama, Ohio, Wisconsin, and Michigan.

The significance of the tabulation, according to R. S. Calland, acting supervising engineer of the Central Valley Project, is that virtually the entire country receives direct business benefit from the construction of Shasta Dam, Friant Dam, the Contra Costa Canal, and other features of the project.

Mr. Calland said the figures include



• The "C. F. Weeber" at work in Hawaiian waters for the Hawaiian Dredging Company, Ltd., of Honolulu. Principal part of the dredge is a Bucyrus-Monighan 5-W permanently mounted on the steel hull which is equipped with maneuvering and scow handling winches.

Above: Here is the big International TD-18 TracTracTor at the power end of a dumping and spreading operation. On this job (stripping overburden from a stone quarry) 45,000 cubic yards of dirt had to be removed.

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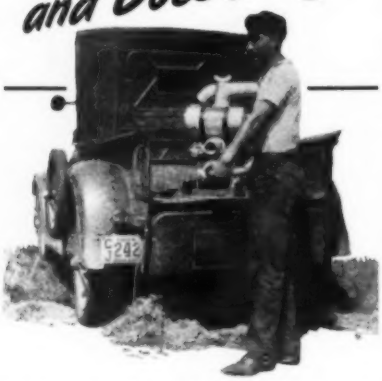

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only expenditures by the Bureau of Reclamation for materials which become a part of the project structures. They do not include large quantites of materials on order for future use, or expenditures by the various labor contractors for plant equipment such as cableways and cranes, and for items such as fuel, food, tools, and explosives.

Project materials purchased up to January 1, 1941, comprise 238,000 tons of cement costing $2,417,414, all spent in California and Oregon: 46,000 tons of structural and reinforcing steel, costing $3,001,872; 5,000 tons of machinery such as pumps and gates, costing $393,045; and miscellaneous materials costing $1,874,199.

Total expenditures on the $228,010,000 Federal reclamation project to the end of 1940, including labor, have reached $54,000,000 most of which is in progress payments on the $82,000,000 worth of contracts in force or completed. Mr. Calland reports that project expenditures now are running about $2,000,000 a month or $46 a minute.

Magoffin Awarded Second Continental Divide Tunnel Contract

Completion far ahead of schedule of the first 8,000-foot section of the 13.1-mile Continental Divide Tunnel on the Colorado-Big Thompson project has made possible the award of a contract covering an adjoining 7,000-foot section, according to reports from the Bureau of Reclamation.

S. S. Magoffin Company, Inc., of Englewood, Colorado, contractor for the first section of the eastern portal of the tunnel, was awarded the contract for this new 7,000-foot section on its bid of $784,711, which was the lowest of three bids received by the government.

The boring of this big transmountain diversion tunnel through the backbone of the Rocky Mountains is proceeding from both ends. Work is under way on a 6,600-foot section of the west portal of the tunnel.

Designed with an inside diameter of 9 feet 9 inches and a capacity of 550 cubic feet per second, the tunnel will carry water from the Colorado River near the east inlet of Grand Lake through the Continental Divide to the eastern slope to irrigate 615,000 acres, now receiving an insufficient supply, in the watershed of the Big Thompson River under the Northern Colorado Water Conservancy District.

In addition to excavating almost 40,000 cubic yards of material for the new 7,000-foot section the contract awarded the Magoffin Company also includes lining the floor of both sections at the east portal with concrete, laying more than 14,000 feet of track along this floor for dump cars, and boring 10,000 feet of pilot or exploration holes ahead of the tunnel excavation to determine in advance the nature of the materials to be excavated.

The lining of the tunnel floor with concrete is necessary because a portion of the material excavated for the first section was allowed to remain to form a working floor. Under the contract this material will be removed and certain drains constructed before lining the entire length of the two sections. The track will be laid on this concrete floor and will remain in place upon completion of the contract.

Savage River Dam Operations

By Howard Wharton

The Savage River Dam project, designed to make possible greater utilization of water resources in the mountainous western section of Maryland, has just entered its second year of construction, with operations proceeding at a good pace.

All preliminary clearing and stripping of the dam site has been completed, and clearing of the reservoir area is almost finished. A 1,193-foot long outlet tunnel has been holed through and concrete lined; and considerable progress has been made on the two other major phases of the work—the rolled-earth and rock-fill embankment and the rock excavation for the spillway.

Under construction by the Work Projects Administration, this dam, now over one-fourth completed, will require an estimated 1,985,000 cubic yards of earth and rock fill. The project is sponsored by the Upper Potomac River Commission, a Maryland State agency. It offers an interesting example of the degree to

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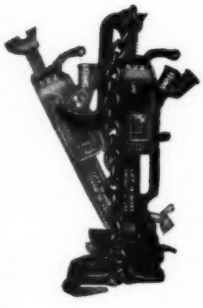

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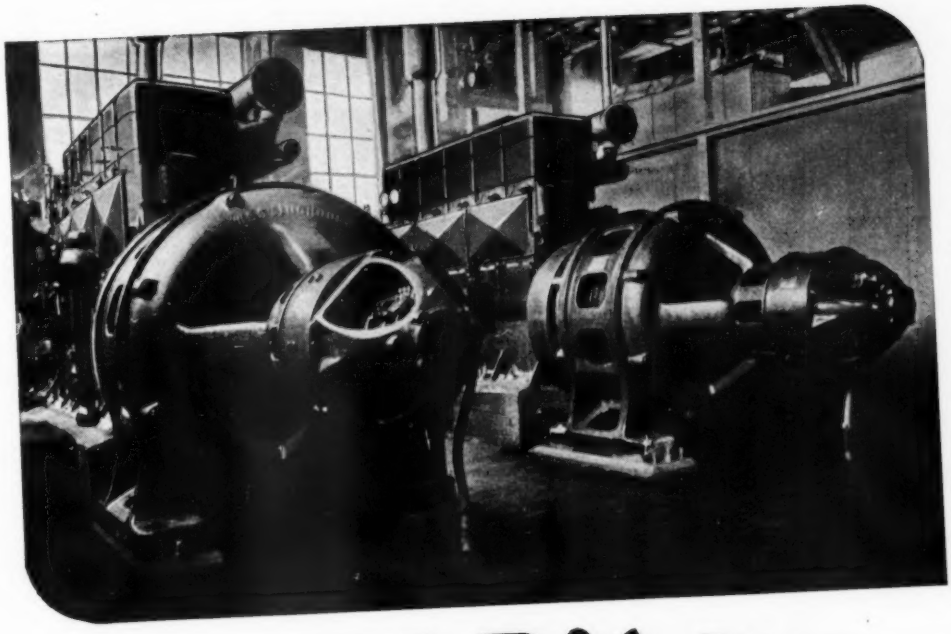

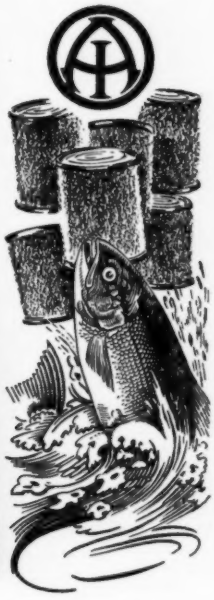

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• Fill placing operations on the Savage River Dam. Note rock excavation activity for the dam's spillway in the background. (WPA photo)

which site-materials may be used in such construction when careful planning and the simultaneous operation of major phases of the work are coordinated.

Stretching 1,068 feet (exclusive of the spillway channel width) across the Savage River Valley between Big Savage Mountain and Backbone Mountain in Garrett County, a site 32 miles southwest of Cumberland, Maryland, this 175-foot high structure, when completed, will create a storage reservoir, impounding approximately six and one-half billion gallons or 20,000-acre feet of water. This reserve of water will be used during dry months to increase the flow of the North Branch of the Potomac, of which the Savage River is a tributary, by an estimtaed 60,000,000 gallons per day, or about 93 cubic feet per second.

The resulting increased flow of water will benefit the industries located along this river between Bloomington and Cumberland, which suffer from water shortage during dry months, and will be an incentive for expansion of industry in this area. In addition, serious stream pollution from municipal and industrial wastes will be eradicated. The reservoir will serve also as a source of water supply for Westernport, Maryland, and Piedmont, West Virginia.

All of the exploratory surveys, test borings, soil investigations, and designs for the Savage River Dam were completed under a WPA project which was supervised by U. S. Army Engineers. This included an extensive program of auger borings, test pit excavation, and sampling for location of the prospective borrow areas, core borings on the dam and spillway sites; the systematic examination in the laboratory of foundation materials upon which the dam and spillway would be constructed and the materials to be incorporated in the embankment; and the usual location, property, and topographical surveys incident to such construction.

An earth and rock-fill structure was decided upon as it could be constructed at a considerable saving; all of the selected earth and rock fill being available at or within reasonable hauling distance of the site. The rock at the dam site and in the reservoir area consists of sandstones, shales, and limestone. Sufficient timber was available also for all rough lumber forms, temporary bridges and part of the job buildings.

Early construction work included the starting of the clearing of about 350 acres in the reservoir and flood flowage area and 20 acres in the dam and construction plant site; stripping 28,000 cubic yards of earth and 2,800 cubic yards of surface rock from the dam and borrow sites; constructing six miles of temporary roads to various operation sites, borrow pits and shops; and the erection of machine shops, garage, saw mill, supply houses and other buildings. Approximately 52,000 cubic yards of material were excavated for temporary facilities; such as, quarry, construction roads, temporary buildings, parking lots, pipe trenches, etc., required during the preliminary stages of construction.

WPA workers diverted the river toward the eastern side of the valley in such a manner as to place the western half of the embankment-fill operation and the outlet tunnel construction on the same side of the stream, and adjacent to the main westerly borrow pit, shops and outlet roads. This made possible more efficient utilization and movement of materials and equipment.

At the same time this permitted the large-scale rock excavation for the spillway on the eastern side, against Big Savage Mountain, to proceed without interference from other operations and provided a constant supply of suitable rock for dam and other required points.

Construction work on Savage River Dam was started October 9, 1939, when 89 men were put to work with picks and shovels. At present, 1,000 workmen are employed by the WPA from Allegany and Garrett Counties, supplemented with 110 pieces of various modern construction equipment. The project is expected to be completed in 30 months.

Daniel S. Pelletier is general superintendent, and George Naill, job superintendent; both employed by the U.P. R.C.

The WPA is represented on the dam by Messrs. C. B. Cornell, assistant general superintendent; J. H. Zimmerman, resident engineer; and Dr. D. F. Peterson, Jr., in charge of laboratory and field tests for soil and concrete.

Simpson Resigns W. Virginia Highway Commissioner Job

Burr H. Simpson resigned as West Virginia state road commissioner in February to succeed Arthur M. Hill as president of the Standard Brick and Supply Company and the West Virginia Sand and Gravel Company, affiliated corporations of Charleston, West Virginia.

Ernest L. Bailey of Charleston was appointed to succeed Simpson as road commissioner, effective February 22. Bailey, who resigned as state director of the office of government reports to take over the road post, was road commissioner from 1933 to August, 1935, when Simpson was named to succeed him.

Commissioner Bailey has appointed

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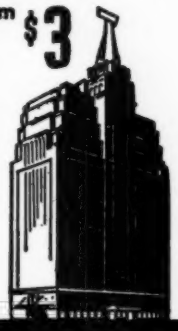

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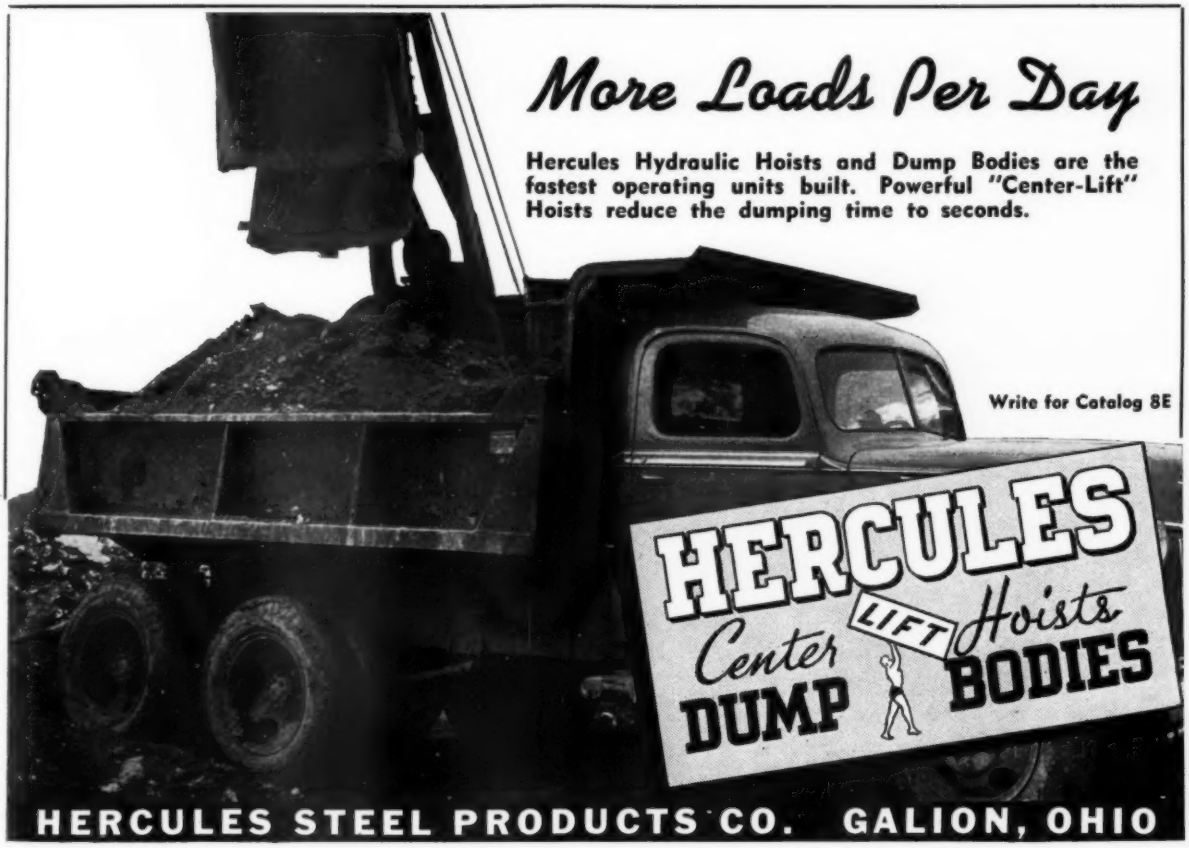

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M. L. O'Neale of Charleston to head the combined engineering departments of the state's construction and maintenance divisions.

Mexican Chief Lauds U. S. Roads

"Good will between the United States and Mexico has never been more apparent in both countries."

So spoke General Jesus de la Garza, secretary of communications in the Mexican cabinet, as he inspected the highway system of southern California as a side trip on a general inspection tour of northern Mexico.

"Now we in Mexico are seeking to cement it further by a highway program which will promote increased business and travel between the nations," General Garza declared.

The general, whose important department in President Camacho's cabinet controls highways, railroads, aviation, telegraph, telephone and radio, was enthusiastic over U. S. roads. Stressing the importance of close cooperation between the two countries in maintaining an excellent highway system along the border, General Garza outlined his country's part of the program to provide increased roads for international travel.

One of the first steps in his border highway program, he said, would be a road between Mexicali and San Felipe. Construction is to start at once, with an initial appropriation of $2,000,000. The Pan-American highway has been completed from the Texas border through towering mountain ranges to Mexico City, and will be finished to Gautemala within two years.

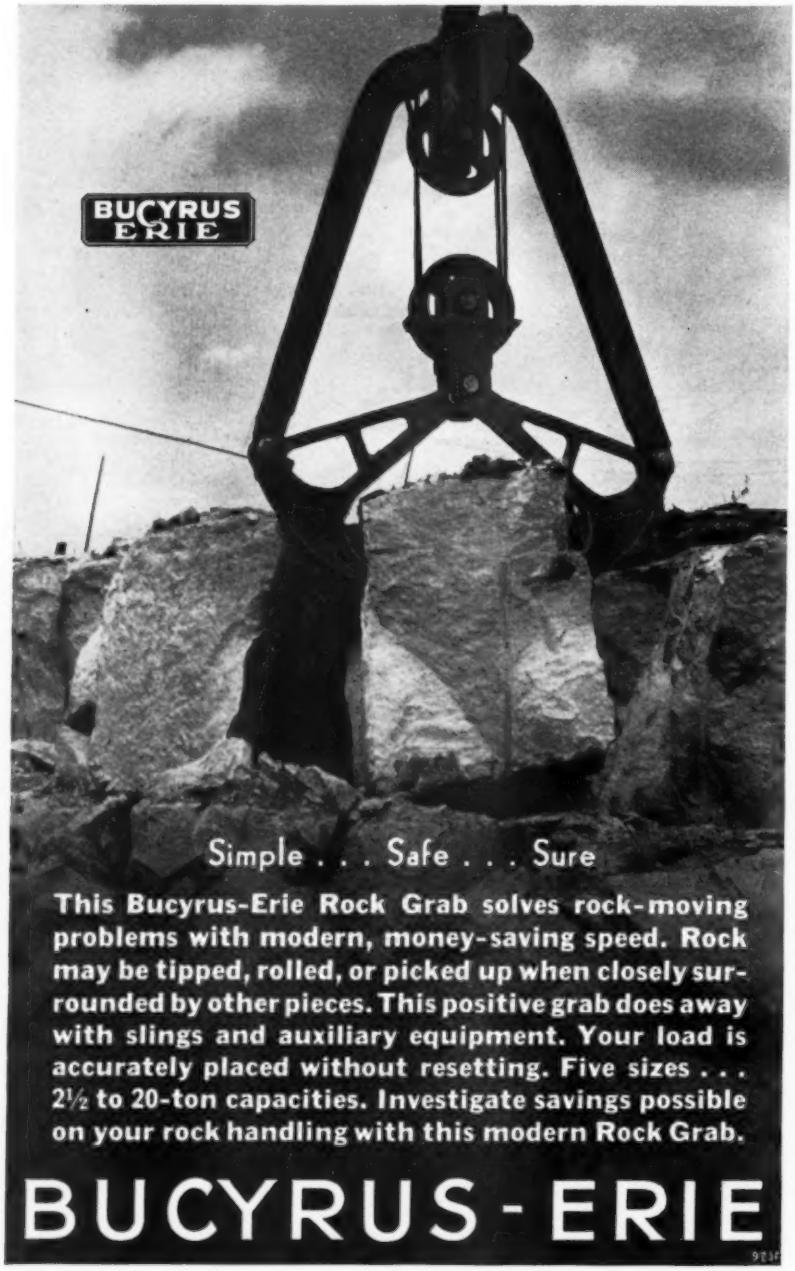
Accompanied by four aides, General Garza flew up from Mexico City to attend a road convention at Mexicali from February 21 to 23. Later the party was feted at the Desert Cavalcade in Calexico, across the border. After an automobile trip with General Sanchez Toboada, governor of Baja California, over the road system as far south as Enseneda, Garza boarded a plane to continue his survey of Mexico's highways and proposed new routes.

New Jersey's Governor Appoints New Highway Commissioner

Governor Charles Edison of New Jersey has announced that he will name William L. Dill to succeed State Highway Commissioner E. Donald Sterner, whose term expires April 29.

Now serving as Regional Social Security Director with headquarters at Philadelphia, Mr. Dill was the unsuccessful Democratic candidate for Governor in New Jersey in 1928 and again in 1934. For 15 years prior to 1930 he served as state motor vehicle commissioner, and in 1934 was named a lay judge of the State Errors and Appeals Court, a position he resigned to run for Governor. He has held his present post since 1936 at an annual salary of $9,000. The highway commissionership is for five years at $15,000 a year.

Commissioner Sterner revealed he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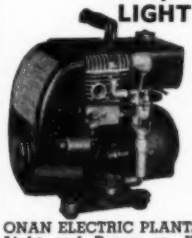

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had asked Governor Edison to keep him in office for a year so he could start the national defense program of highways in New Jersey, which has been the subject of numerous conferences with army officials, but the Governor said he could not see his way clear to do so.

States Build Test Highways

To determine just how well a road "can take it," the state highway departments of Michigan and California have built test highways upon which theories of design and construction are studied under actual traffic conditions.

Michigan's concrete highway is 18 miles long and 22 feet wide. It is open continuously to travel by the public, which in using it helps engineers learn more about concrete pavement design and correlate laboratory studies with construction methods.

Ten miles of the Michigan highway will be used to study such design elements as expansion and contraction joints, the amount of reinforcing steel necessary, and cross-section thickness. The rest of the road will be used for a durability study of concrete. The study may require from four to five years.

California's oval test track, located near Sacramento, has two straightaways, each 200 feet long. The straightaways are divided into a total of eight test sections composed of different types of construction.

Built to determine best design principals of low-cost road construction, the sections of the tract are now being "tested to destruction" under the wheels of heavy trucks.

Each failure in the test panels is repaired after the position and character of the failure is noted. The surface is maintained in good condition during the test so that no sound area will be affected by the failure of an adjoining weaker section.

The oval track may furnish the answer to problems other than those of foundation and surface treatment, California highway officials say. The traffic department wants to get exact information on the relative efficiency of several simple types of automatic traffic recording devices. Traffic lacquers will be tried out on the traffic guide lines to see if any improvement can be made in the standard type of lacquer used by the state.

Grading California Army Camps

By Floyd Suter Bixby

Motorists travelling northward toward San Francisco these days are usually delayed on Highway 101 in the vicinity of San Luis Obispo, Paso Robles and Monterrey, California. These are the locations where camps are being built to house many of the men in America's fast growing army for the days of intensive training that lie ahead.

Row on row of buildings, utilities and tents are visible for long stretches along the highway. Big construction is going on; construction dwarfing anything these cities have seen for many a day. It seems as if the old days when Oklahoma was opened to the homesteaders are being re-enacted with a slightly more modern touch.

Construction workers from all parts of the state and other states have flocked in. They live in homes, in expensive trailers, in not so expensive trailers, and even in makeshift tents. Not a small part of them live in their automobiles, for all buildings in the towns are filled to overflowing.

Not in the wildest dreams of John Steinbeck when he gathered the material for his classic novel "The Grapes of Wrath" in this same locality did he run across the horde of muddy, bearded, cursing humanity so prevalent in these roaring California towns. For these are the men who are building a part of our defense. They are the boys who are "a gittin' things started to rollin.'" They are the construction stiffs; hard rock workers with muddy clothes and dirty faces and greasy hands, whose strength and experience has resulted in about 90 of the army's 127 housing projects being ahead of schedule so far.

They're laying sewer lines, digging dirt, blasting rock and generally changing California topography to the requirements of army plans. At Camp

"GATKE Licks Swinging Problems," Says I.
He came in with feathers drooping. "It's those lousy Swing Frictions," says he. "They're holding us up. If we could only lick them we could go to town."
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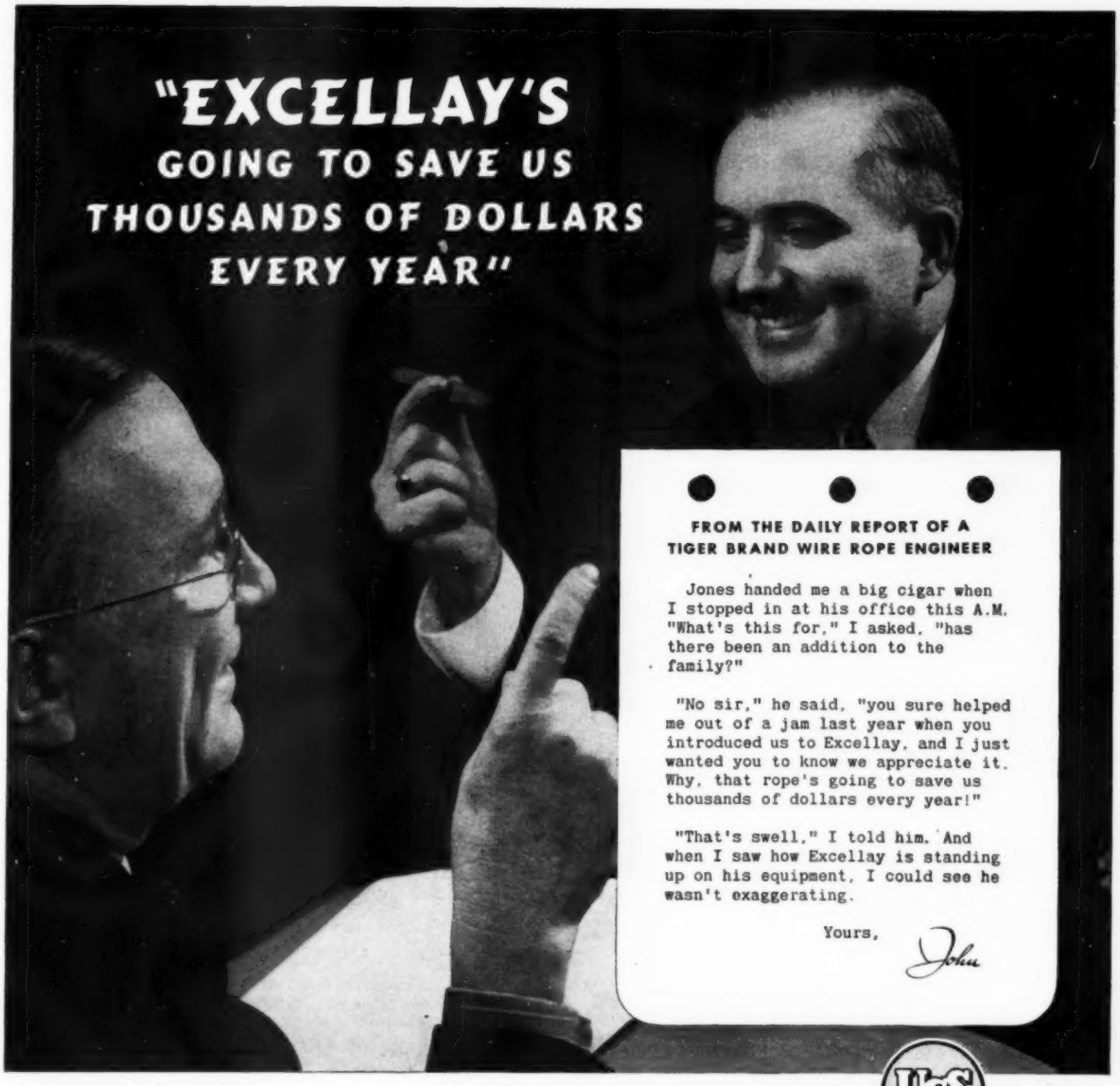
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GOING TO SAVE US
THOUSANDS OF DOLLARS
EVERY YEAR"
FROM THE DAILY REPORT OF A
TIGER BRAND WIRE ROPE ENGINEER
Jones handed me a big cigar when I stopped in at his office this A.M. "What's this for," I asked, "has there been an addition to the family?"
"No sir," he said, "you sure helped me out of a jam last year when you introduced us to Excellay, and I just wanted you to know we appreciate it. Why, that rope's going to save us thousands of dollars every year!"
"That's swell," I told him. And when I saw how Excellay is standing up on his equipment, I could see he wasn't exaggerating.
Yours,
John

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• L. E. Dixon's 1½-yard Bucyrus-Erie shovel at work for Uncle Sam on the topography of California's San Luis Obispo army camp. This photograph was taken before the recent rainstorms that made the job muddy going.

San Luis Obispo, Contractor L. E. Dixon of Los Angeles has turned over a large part of his equipment to the office of the Constructing Quartermaster; equipment that is giving full time service day after day through the rainy season.

Thousands of yards of hard packed clay and rock is being moved by drilling it with air hammers powered by a Gardner Denver compressor, loading it with 45% powder, and jarring it out in pieces small enough to be picked up by the shovels. This work is old stuff to these men who are forging ahead in the program. One gets the idea that if a sudden order came to turn all lights out, that they could go right on ahead drilling, loading trucks and swinging shovel booms, no matter how dark the night.

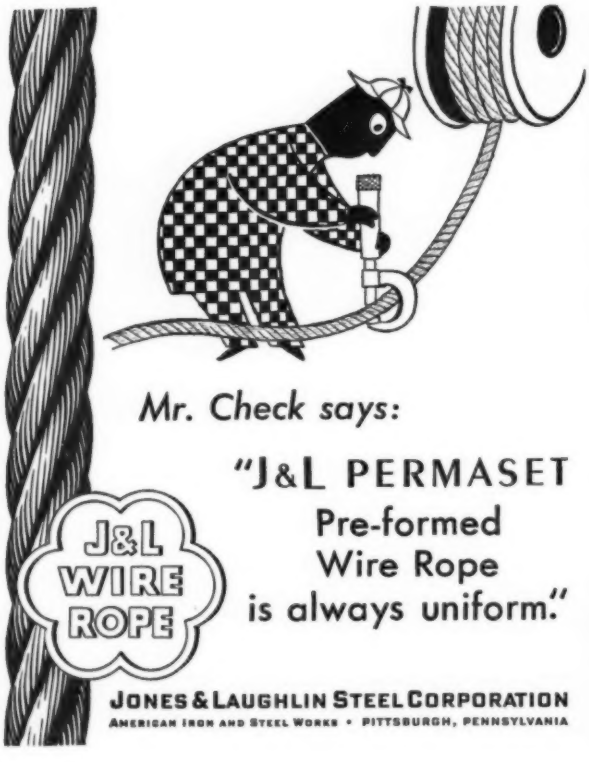
One of the shovels in the Dixon contract is a new Bucyrus-Erie 37-B, carrying a 1½ cubic yard dipper on the end of its 16½ foot dipper stick. This machine was put in the toughest part of the digging, down in a mass of broken rock and heavy clay. It consistently digs and loads about 100 cubic yards per hour of this material, being restricted only by the haul roads which are axle deep in mud from the rains.

E. S. Larson, Major, QMC, is in command of the camp for the Quartermaster's Corps of the U. S. Army and Floyd Gidinsky, 1st Lieut., QMC, is directing most of the work for the office of the Constructing Quartermaster.

Ohio Improves Strategic Roads

Although no money as yet has been appropriated by Congress for military highway purposes, the Ohio department of highways is going forward with such a construction program of its own volition, setting up projects on the strategic network so far as possible to avoid delay.

State Director H. G. Sours said if and when Congress enacts a bill appropriating up to $287,000,000 for military



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highway work in the United States, "Ohio's share will be expended precisely where and when the Army and Navy departments dictate—the highway department will have nothing to say about that phase of expenditure."

In the meantime the state is pushing ahead with its regular improvement program, and the state-federal aid program, involving expenditure of $7,252,336, on a dollar matching basis, all to go into federal aid highways, many miles of which are included in the priority military highway system.

Military highways are a connected system of routes which have been designated by the War and Navy departments as the roads of principal importance from the standpoint of national defense.

Broadly viewed, the military highway system in Ohio consists of a system of main trunk routes totalling 1,312.5 miles, of the 18,565 miles of roads in the Ohio department of highways system, outside and inside municipalities.

Recently Director Sours informed the Washington government that it would require expenditure of $24,563,800 to bring the military highways in the state up to minimum standard requirements of the War and Navy departments.

Included in the military system in Ohio are 808.4 miles of road below standard as to width, alignment and the like, and there also are 40 bridges which will require strengthening, widening and replacement.

To bring the highways alone up to minimum War department standards would cost $21,847,500, Director Sours estimates, while the cost of bringing the substandard bridges up to War department requirements would cost $2,718,000.

Ohio's priority military roads bisect the heavy industrial areas of the northern part of the state, the areas around Toledo, Cleveland and Akron, with adequate transverse routes north and south, and outlets into Pennsylvania at East Liverpool and Conneaut.

In the military highway network throughout the United States there are approximately 74,000 miles of priority roads and auxiliary roads.

The military system of highways in Ohio connects all of the industrial regions, where there also is the heaviest concentration of population, and connects the numerous industrial plants now under construction, or already in operation, which are concerned entirely with carrying out the national defense program, and likewise offers adequate means of transportation from those areas should a condition ever arise in which there is an attack upon those regions.

It has long been the opinion of Director Sours that military or strategic highways also should be the highways for the transportation of that vast volume of business which is carried on normally when there are no defense orders to be turned out, or defense plans to be considered.

"Military roads also are commercial highways," Director Sours says, "and as such should receive every consideration to the end that there is provided all the necessary roadway required for the quick movement of military accoutrement and men, and for commercial activities at all times."

Announce Construction Safety Record

A new all-American construction safety record has been established by the du Pont construction forces in building the smokeless powder plant for the United States Government at Charlestown, Indiana, according to information

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POWER SCRAPERS

A quick-loading bucket, hauled back and forth by wire cables, offers the simplest way to handle earth and bulk materials wherever there is a haul of 100 ft. or more. Thousands of engineers and contractors now recognize this economic fact and use Sauerman Power Scrapers for their long range jobs.

Large Sauerman Scraper Bucket Designed for Heavy Excavation Work.

This Picture Shows a Small Sauerman Scraper Reclaiming Coal Mine Screenings from Waste Pile to Washing Plant.

The first cost of a Sauerman Power Scraper is reasonable. The machine is easy to operate; any workman can learn to run it efficiently with very little practice. The power cost and also the maintenance expense are exceedingly low per cubic yard of material handled. Wearing parts are few and are easily accessible for inspection or repair.

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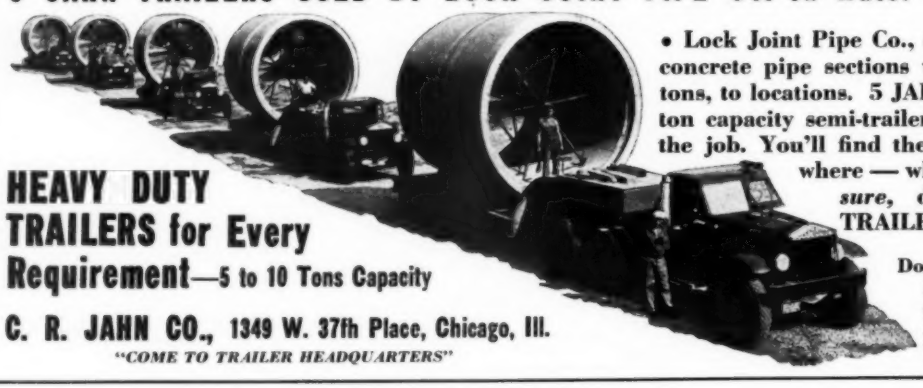
5 JAHN TRAILERS USED BY LOCK JOINT PIPE CO. on Water Supply Project



• Lock Joint Pipe Co., transporting 5,300 concrete pipe sections weighing up to 50 tons, to locations. 5 JAHN Heavy Duty 50-ton capacity semi-trailers were used to do the job. You'll find the same story everywhere — when you want to be *sure*, depend on JAHN TRAILERS.

HEAVY DUTY TRAILERS for Every Requirement—5 to 10 Tons Capacity

Don't take our word for it — ask any JAHN owner — there's probably one near you. Write for full details.

C. R. JAHN CO., 1349 W. 37th Place, Chicago, Ill.

"COME TO TRAILER HEADQUARTERS"

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released by officials of E. I. du Pont de Nemours & Company.

As of midnight on February 20, more than 3,650,000 man-hours had been worked without a single time-losing injury. This surpassed the record of du Pont forces established on December 27 last while constructing a smokeless powder plant for the British Government near Memphis, Tennessee. On this plant a total of 3,000,000 "non-injury hours" broke a previous record for the construction industry of 1,929,428 hours.

The Memphis record has continued unbroken, and although now passed by the Charlestown project, has reached 3,550,000 hours.

Bullgrader Gouges Roads to Mountainous Oil Lease

By Floyd Suter Bixby

Oil! Today oil is equally as important as shells, ships or submarines. Very often it is as hard to get, for Mother Nature was not always careful to leave the top of the ground level over the oil bearing sands.

Ten miles north of Ventura, California, the Chanslor-Canfield Midway Oil Company, a subsidiary of the Santa Fe Railroad, is working a lease on a steep mountain overlooking the Pacific Ocean. While their lease is restricted in area, the elevation range runs from sea level to plus 500 feet in less than half a mile. Three drilling rigs working continuously on the drilling of new wells are pushing the development of the Chanslor property. At the present time the daily output is something like 5,000 barrels.

To get the oil out, engineers of the company ran into the problem of building roads up the steep mountainsides to haul drilling equipment in to the well sites. Fortunately enough, this turned out to be not so big a problem after all, for they brought in a piece of equipment especially designed for that kind of work. An International TD-18 tractor with a Bucyrus-Erie P-24 power control winch and one of the new Bucyrus-Erie bullgraders was purchased to gouge roads out of the mountain and to level off the drilling sites. When this machine finished its work it was easy to haul drilling supplies right up to the site with trucks, using the haul roads made by the bullgrader.

The surface of the mountain was rough, running the variety of materials all the way from rock and cemented conglomerate down to fine silt. Some of the material was tough enough for a ripper to be employed in loosening it. Many of the features of the bullgrader were especially suited to the needs of the Chanslor firm, who needed a cheap, effective way of getting their work done.

Working high up on a hill where the footing was none too secure, Operator B. F. Karne was glad to share in the benefits of engineering skill that made this unit a balanced one. For the addition of the Bucyrus-Erie blade has not changed the balance of the tractor, and the full power of the machine is still equally distributed over the tractive area on a hard push. This factor came in mighty handy in places where it would have been risky to life and property if the tractor had failed.

One of the hardest things in working on a hillside is to open up enough territory to bring the tractor in on an even keel. Once the tractor has leveled off enough working room, it is easy with the new type angling blades to gouge fresh material out of the toughest cut. Operator Karne did things with the TD-18 which would make a mountain goat blush in envy.

During the winter rains drilling operations must go on just the same through mud and slush up to the axles of all equipment. Every gallon of that oil fills a vital world need. Down on the ocean are several long piers built out to deep water to carry the oil lines to the holds of waiting tankers. So rain or shine, the trucks must get through with their loads of tools, bits, casing and other drilling supplies. Working in mud sometimes almost up to the top of the tracks, the tractor drags trucks through by brute force. Supervisor W. F. Greenwood, in charge of the machine shop where necessary repairs are made, said that this was easy going for the TD-18, whose motor very often was never shut off for 16 hours at a time.

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SMALL and PORTABLE
100 TONS of POWER and UP
For use as PULLER - PRESS - or JACK to save you time and money in dismantling worn-out or broken-down equipment and in reassembling machine parts right in the field. Makes extra profits, too, on other types of lift, pull, or press work.
Manufactured in 100, 150 and 225 ton sizes, the BECO Press can be quickly separated into hand portable units and transported out on the job as well as used in machine-shop repair work. Write now for information about this profitable investment which pays quick dividends.
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Aqueduct Contract

(Continued from page 205)

spreaders between the ribs, and channel iron purlins resting on the ribs, provide support for blocking and dry rock packing to support loose rock. Wood blocking is only of temporary nature and must be removed before the concrete lining is placed. No permanent wood lagging or continuous longitudinal or radial wood posting or blocking is permissible. A typical crew for steel support work and blocking consists of a foreman, 4 miners, 4 miners' helpers and 2 laborers.

Water leakage into the tunnel during construction was expected, by the Board of Water Supply, to require the pumping of 3,000,000,000,000 foot gallons. Actual leakage at the time the job was visited was 300 gpm at shaft 2 when 16,000 linear feet of tunnel had been excavated; 80 gpm at shaft 2-A with 16,000 linear feet of tunnel excavating; and 220 gpm at shaft 3 with 26,000 linear feet of tunnel excavation. Three hundred gpm, the maximum leakage, doesn't sound like much, but multiply it by shaft depth and the number of minutes in a month and you have the astronomical figure of 10,692,000,000 foot gallons. Leakage in most instances is controlled by grouting through grated pipes.

In the south heading at shaft 2, between stations 283 and 284, inclined strata of rock, beneath a deep deposit of glacial drift west of Rondout Creek, were found to be heavily water-bearing. The problem of boring through this rock slowed progress at this particular heading, and at the time the job was visited, a concrete-lined drift of 7-foot diameter was being advanced ahead of the full-sized heading. Large amounts of grout were forced into the surrounding crevices through pipes embedded in the temporary concrete lining of the drift. The hardening of the grout and the consequent shutting off of the water were expected to prove effective.

Explosive gases were found in the tunnel at shaft 2-A, particularly in the north heading, where strained and broken rock conditions were also encountered. Gas detectors are constantly employed in this tunnel and a fire boss system is in operation with special equipment and regulations.

Complete Ventilation System

Continuous ventilation is maintained at this shaft with two Type FS-575 Ingersoll-Rand blowers, powered by 100 HP 2,300 volt direct-connected Westinghouse 3,550 rpm constant speed motors, and delivering 11,400 cfm, each, at atmospheric pressure. These can be used either as exhaust fans or blowers, and the air carried to or from either or both headings as required. Identical blower equipment is installed at the other two shafts.

Two emergency exhausters have also been installed at each of the three shafts; these are Size 35 Sturtevant Type 4 planing mill exhausters of 5,000 cfm capacity, powered by 10 HP 440 volt General Electric induction motors. All blowers and exhausters are located above ground and large pipes lead from them down the shafts and into the headings.

Despite gas hazard, "popping" rock and exceptional depth below ground, the Rosoff tunnel crews, during a typical month, drive nearly 7,000 linear feet of tunnel at the six headings. This includes the placing of steel supports up to the face of each heading, and the blocking of the wall and roof rock.

Surface Operations Important

Surface operations at the shafts directly affect the efficiency of the excavation work in the tunnels far below ground and they have been carefully planned.

The hoists at all three shafts were made by Ottumwa Iron Works. Those at shafts 2 and 3 have drums 96″ diameter x 78″ width. Shaft 2-A, the deepest shaft, has a drum 119″ diameter x 103″ width. Hoist cable is 1½″ flattened strand A. Leschen & Sons "Hercules" Red Strand wire rope, Type G, in two sections, one for each headframe sheave. Each hoist cable section at shafts 2 and 3 is 1,300 feet long, while at shaft 2-A the length of each section is 2,040 feet. Hoist power at all shafts is furnished by General Electric 2,300 volt induction motors, which are 500 HP at shafts 2 and 3 and 700 HP at shaft 2-A. A Lilly hoist controller regulates cage and skip speed to 750 fpm at shafts 2 and 3 and to 1,000 fpm at shaft 2-A.

Headframe assemblies at all three shafts were designed and erected by Archer Iron Works. Each is 108 feet high from shaft collar to center of sheaves. The two sheaves on each frame are 8

• Cross section view of typical tunnel section showing detail of steel support work. Note ventilating pipe carrying air from the Ingersoll-Rand blowers.

• Two Caterpillar tractors equipped with LeTourneau 'dozers work side by side as they grub underbrush off the site of the Rosoff gravel pit.

feet in diameter at bottom of grooves and have steel spokes with detachable cable grooves. Two balanced cages hang from these sheaves. One is a man cage, 4'6½" x 7'0"; the other is a material cage, 5'7" x 7'0". Both cages are equipped with Archer safety devices.

Beneath each cage is a 7 cu. yd. muck skip, attached to the same bails as the cages. The skips dump into Archer-built hoppers of 50 cu. yd. capacity.

Muck is hauled away from the chutes beneath the hoppers with 12-yard Mack dump trucks, 2 trucks serving each shaft. A Lorain No. 40 truck crane, mounted on a Mack truck, is also stationed at each shaft. The cranes are equipped with 25-foot booms and are used for general utility work around the shafts, for there is always plenty of heavy lifting to be done.

Special ground-level muck handling equipment on the dump at shaft 2 includes a LeTourneau bulldozer powered with a D7 Caterpillar tractor; a 12-yard LeTourneau scraper pulled by a D8 Caterpillar tractor; and a LeTourneau rooter, pulled when needed by the D8.

Battery charging plants, arc welders, blacksmith shops, machine shops and other pieces and assemblies of service equipment are provided at each shaft.

Preparing the Aggregate

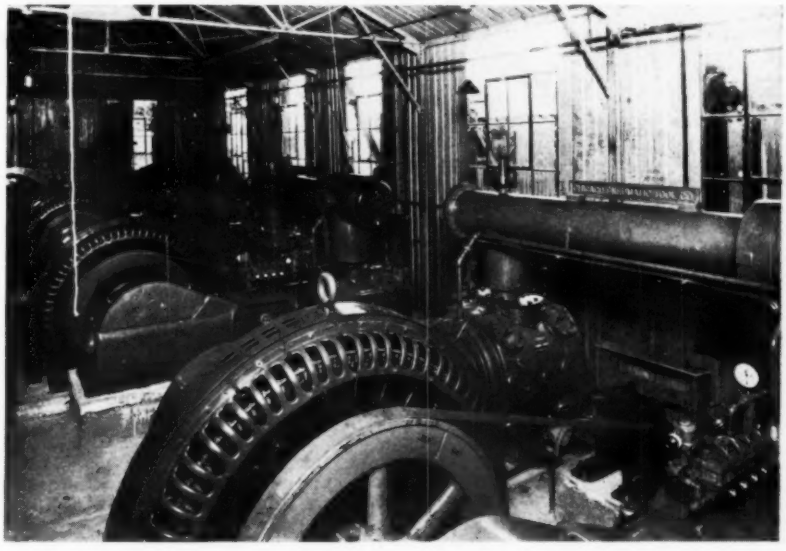
More than 750,000 cubic yards of aggregate will be needed for the concrete tunnel lining and other purposes. Suitable fine and coarse aggregate is obtained from Rosoff Sand & Gravel Company, an affiliate of Samuel R. Rosoff, Ltd. High up on a hill near Napanoch, not far from shaft 2, the Rosoff Sand & Gravel Company is working a large deposit of sand and gravel and has installed a modern preparation, storage and mixing plant.

The site of the deposit, originally covered with a light growth of underbrush, is cleared with two LeTourneau bulldozers, pushed by D7 Caterpillar tractors. The tractor operators have worked out a novel way to increase the productivity of their operations. Instead of following each other, or 'dozing in independent areas, the two operators work side by side in parallel. The bulldozer blades are kept about 8 or 10 inches apart, which produces, in effect, a bulldozer blade that is 17 feet wide, and which enables the parallel tractors to shove a huge load because spill-off at the inner end of each blade is practically eliminated. Removal of the 4 to 6 feet of overburden is handled by a 1¾-yard Osgood shovel.

The sand and gravel is loaded out with a 54-B Bucyrus-Erie diesel powered shovel, swinging a 2½-yard dipper. This particular model of shovel was selected because of the need for capacity and strength combined with fast, smooth operation. It is a size and type more frequently seen in quarries and mines than in sand or gravel pits, where the digging is so much easier and there is no rock to be handled. It has proved to be a wise choice, as the demand for aggregate is in excess of 2,000 cu. yds. per day, which the 54-B is easily able to supply.

Material is hauled from the 2½-yard shovel in 10-yard Mack dump trucks. Average length of haul is 800 feet to a I-beam grizzly. Passing through the grizzly into a gated hopper, the sand and gravel slides down a long chute to the feed hopper of a belt conveyor, which takes it up again to the top of a Smith Engineering Works crushing, size-grading and washing plant. Wash water is supplied by two Worthington 8LG-1 single-stage

• Interior of compressor house at shaft 2-A. Three Chicago Pneumatic 1250 cfm compressors provide the all-important air for tunnel ventilation.



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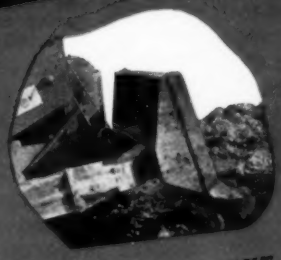
Cable Controlled BUCKEYE "UNITILT"

INTERCHANGEABLE BLADES ON UNITILT FRAME — The Buckeye UNITILT frame is universal for Buckeye Blades! Changing from Bulldozer to Trailbuilder blade or vice-versa is quickly done by one man pulling two kingpins. *Tilting* of the blade requires the adjustment on *the frame of one belt only* to raise or lower at either end! The only interchangeable unit that will tilt a Bulldozer blade!

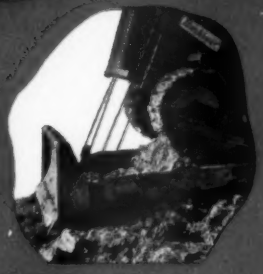
BLADE ROLLS THE DIRT — Rolling action of blade enables operator to take deeper cuts because *the load is rolled up ahead* and *not pushed ahead* — no dead weight — less power required — bigger "payloads"—moves faster —less strain on tractor — blade digs its own way in — no cylinders needed for down pressure.



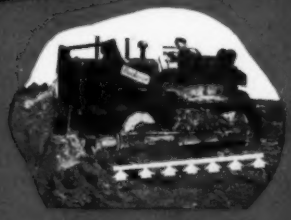
BLADES HUG FRONT OF TRACTOR — Bulldozer and Trailbuilder blades hang *close* to radiator, greatly reducing load and wear on front idlers and track rolls. Note rigid, close-coupled construction.

TRAILBUILDER EASILY ANGLED — It's a simple operation to install the extension to either side arm to angle the blade either way. A second member is also installed to give great rigidity.

BULLDOZERS and TRAILBUILDERS!



FULL FLOATING BLADE—Side arms pivot at drive end of tractor — free-swinging action up or down for high lift and deep bite of blade. Buckeye cable control gives tremendous power and lightning-fast action!



BALANCED TO UTILIZE FULL TRACTOR POWER—Full lengths of crawlers *stay on the ground* — no lost traction — maximum pushing power assured — mechanical downward pressure not required — no cylinders for pushing blade down and tipping tractor up.

PUSHING POWER APPLIED CLOSER TO CUTTING EDGE!

Use EITHER BLADE on the same frame

THE new Buckeye UNITILT design brings you long-awaited improvements in Bulldozer and Trailbuilder construction: You buy *only one* universal frame — use it with all Buckeye Blades! • You get Buckeye's patented tilting device which lets the operator quickly tilt his blade the way he wants it and keep it there! • You reduce the heavy overhanging load on the front of your tractor because the blades are hung so they "hug" the radiator! • You get more out of your tractor because Buckeye *balance* keeps the full lengths of the crawlers *on the ground!* • You get a rigid, rugged frame that will take the battering of the toughest bulldozing without a whimper! • You get Cable Control at its best with Buckeye Power Control Units — smooth, fast action with no jerk on the line, greater lifting power, simplicity and freedom from trouble!

In short, Buckeye UNITILT Bulldozers and Trailbuilders are rarin', tearin', brutes for punishment that'll move *more yardage per day*, push bigger payloads and give you bigger profits on any job! Don't wait to put this up-to-the-minute equipment on your tractors. Write to Buckeye *today!*

BUCKEYE TRACTION DITCHER COMPANY
Findlay, Ohio

Built by Buckeye

Convertible Shovels

Trenchers

Tractor Equipment

R-B Finegraders

Road Wideners

Spreaders

• A maintenance man sharpens ⅞" crucible steel bits on an Ingersoll-Rand machine. Bits are discarded when they are less than 18" long.

pumps which deliver 2,500 gpm against a 300-foot head and are powered by 250 HP 2,300 volt G. E. motors. Cleaned and sorted to three sizes, the aggregates are delivered by separate belt conveyors to a three-compartment Blaw-Knox storage bin. One compartment stores fine aggregate, all of which must pass through a ¼" mesh screen. Another holds the small-sized coarse aggregate, which must pass through a ¾" mesh screen and be retained on ¼" mesh. The third section contains large-sized aggregate.

Charles M. Clark is chief engineer for the Board of Water Supply of New York; Roger W. Armstrong is deputy chief engineer in charge of construction; Neil Holdredge is department engineer in charge of all tunnels north of shaft 10; Max F. Freund is division engineer in charge of shafts 2, 2A and 3, and John G. Mergott, Arthur E. Hilliard, Roderick C. St. Leger, Francis J. Colgan and John Horn are assistant engineers on the Rosoff contract. Charles O'Neill is contract clerk.

Samuel R. Rosoff is president of Samuel R. Rosoff, Ltd.; Arthur H. Diamant is vice-president; David E. Stinson, general master mechanic; James Fisher, general superintendent; Fred W. Stiefel, chief engineer; Philip S. Miller, first assistant engineer; W. Quick, superintendent of shaft 2-A; Walter Dunham, superintendent of shaft 3; and L. S. Penland, superintendent of shaft 2.

Stripping Pennsylvania Anthracite

(Continued from Page 213)

Caterpillar tractors, an RD-7 and a diesel-powered 50, carrying LaPlant-Choate bulldozers, were used. Finish grading was done with a diesel-powered No. 9 Caterpillar Auto Patrol.

Two service trucks supply equipment with fuel, lubricating oil and water once each shift. Two utility trucks are kept busy with odd jobs. All Mack trucks have 40 x 8 front tires and 11.25 x 24's on the dual rears, made by Lee. A complete garage, machine shop and welding shop is maintained. Every Saturday is official "Repair Day," the time when minor adjustments and repairs such as reversing drag line ropes, taking up caterpillar treads, changing dipper and bucket teeth, and replacing dipper and bucket rivets and bolts are made. One man is held responsible for a weekly inspection of boom suspension cables. The helper on a shovel or dragline takes his lunch hour early and does his oiling and greasing during the operator's lunch hour. A thorough greasing and oiling job is also done between the last of the previous day's shifts and the first of the next.

Meet the President

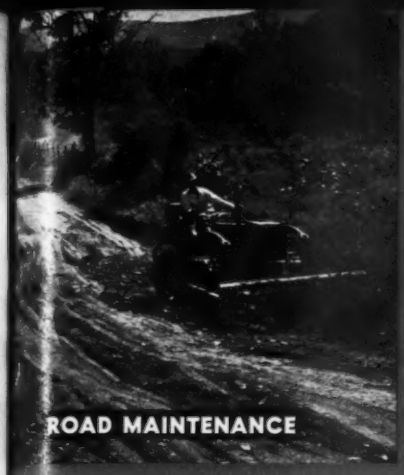
William F. Carey, president of Carey, Baxter & Kennedy, Inc., is also Commissioner of the New York City Department of Sanitation and was recently granted a leave of absence by Mayor La Guardia, reportedly to supervise the construction of army cantonments, for which his services were requested by William S. Knudsen, production co-ordinator of the National Defense Advisory Commission. Mr. Carey is a canal builder, railroad builder, an expert on land fill operations and a former president of the Madison Square Garden Corporation. At the age of 25 he was general superintendent of the digging of the Culebra Cut section of the Panama Canal. He also has built railroads in North and South America and China.

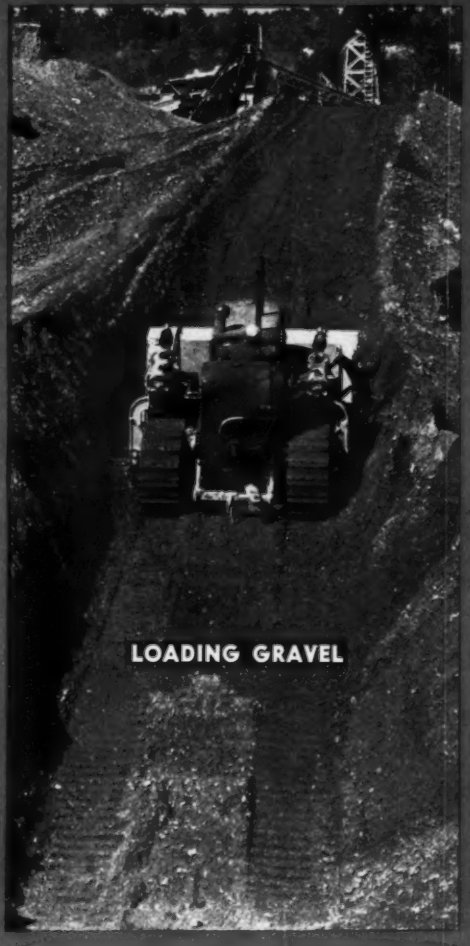
John Morton and W. E. Conroy are vice-presidents of Carey, Baxter & Kennedy, Inc.; James H. Scofield is superintendent; A. E. Coddington, engineer; O. E. Pearson, master mechanic; Al Porter, transportation superintendent; Harry Blew, foreman at Ellangowan; Fred Seaman, foreman at Boston Run; Ralph Havard, chief clerk; and Stewart Griffin, timekeeper.

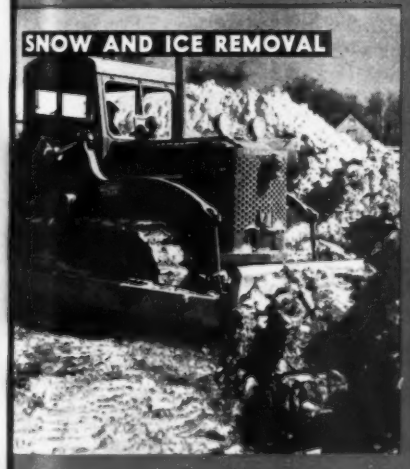
Charles Brown, division engineer of the Ashland Division, is the engineer in charge of strippings for Philadelphia & Reading Coal & Iron Company, associated with Elmer Young, division engineer of the Mahanoy Division, and Joseph Petusky, assistant division engineer of the Mahanoy Division.

Carey, Baxter & Kennedy, Inc., since its organization in 1930, also has operated many large strippings in the anthracite coal regions for the Hudson Coal Company, the Pittston Company, the Centralia Collieries Company, the Lehigh Valley Coal Company and Coxe Brothers Coal Company.

• Machine teamwork at the Boston Run strippings. The 9-yard walker and 3-yard dragline at the right are casting overburden for the 2½-yard dragline at the left which in turn casts it to the spoil bank at the extreme left.







P105

Bucyrus-Erie Company

SOUTH MILWAUKEE • WISCONSIN • U. S. A.

• General operations view at Cherokee, showing two of the 2-yard Bucyrus-Eries in action.

Cherokee Dam

(Continued from page 209)

the soil and its condition shows when the ultimate compaction is being obtained with the equipment used. The soil testing laboratory has been removed from Watts Bar Dam and is now established at Cherokee Dam.

Clay for the rolled fill sections is coming from two major borrow pits. One pit is located 2,500 feet west of the north embankment; the other is located 3,800 feet west of the south embankment. The length of haul is suited to heavily loaded high speed equipment. The equipment used for this job consists of a fleet of 14 Model F, bottom dump, Euclid Trac-Truks, having a capacity of 13 cubic yards per truck (16.5 cubic yards heaped) and five LeTourneau Tournapulls Model A with RU scraper, having a capacity of 23 cubic yards each (30 cubic yards heaped). The Euclids are operated at their maximum speed of 25 to 30 miles per hour and the Tournapulls at their maximum speed of 20 to 25 miles per hour. In order to have the equipment operate at these speeds, special attention was given to the road system from the borrow pits to the embankments. To complicate the situation, the road from the south borrow pit to the south embankment had to cross Tennessee State Highway No. 92, the camp area, and the construction plant area. Further, the rigid construction schedule means that rolled fill operations and concrete placing operations must go on simultaneously and without interfering with each other. Maximum production of each must be obtained to meet the schedule. The problem was immediately solved by building an independent road system for earth and rock moving equipment. Where roads intersected, underpasses and overpasses were constructed. Cribs, using available logs from the reservoir clearing, were used to build the abutments of the overpasses. The cribs were filled with rock from the quarry. Steel and timber construction was used for the decks.

Since the speed of operation depended upon the road conditions over which the hauling equipment travelled, special attention was given to the surfaces. Two Adams Auto Patrol graders are on the job to keep the roads in first-class shape.

• An elevating grader loads fill from the borrow area to Euclid Trac-Truks for a fast trip to the dam proper.

Control Moisture of Borrow Material

Particular attention is being given to the control of moisture in the borrow pits. The clay in its natural state contains moisture considerably in excess of the optimum. By careful selection, it is possible to get the optimum moisture in the material to assure maximum compaction. This saves the expense and trouble of adding water on the fill. The drainage of the borrow pit is receiving more care than usual. When rain occurs, the Tournapulls are used to strip a new area of the pit rather than wait for the pit to dry out. LeTourneau scrapers immediately strip the wet material from the top of the rolled fill. With a minimum of delay, rolled fill operations are again under way.

Earth moving on the job is handled by two major methods. The first method uses elevating graders at the borrow pits to load the Euclid Trac-Truks which haul the material to the fill. The second method is by the use of the LeTourneau Tournapulls. The combination of the two methods has a distinct advantage. For best operations, an elevating grader should travel on comparatively level surfaces. The Tournapulls, which are self-loading, are used to remove the high spots and level the pit.

It has been found advantageous to employ a snatch tractor and a push tractor to assist in loading the Tournapulls. The snatch tractor permits easier loading, faster loading, a better load, and saves strain on the unit by preventing jacknifing. To facilitate opera-

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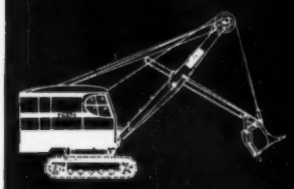
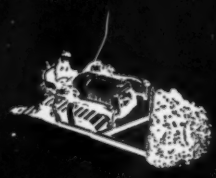
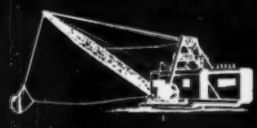
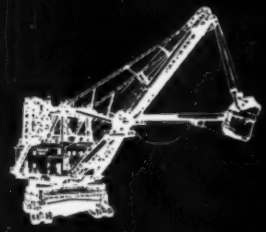
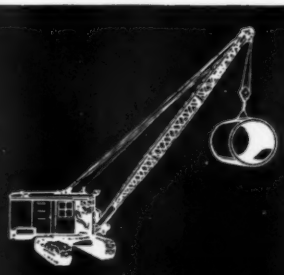
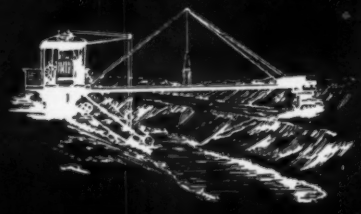



tions, a special eye was designed by the job forces and attached by cables to the Tournapull tractor end. The Caterpillar RD-8 unit that serves as the snatch tractor is equipped with a throw hook.

The push tractor is an Allis-Chalmers HD-14 to which a Le-Tourneau rooter is attached. When not engaged in assisting in the loading of a Tournapull, the tractor and rooter are used to plow the borrow pit to make the elevating grader work easier.

The Auto Patrol graders, when not engaged in shaping up the haul roads, are used to terrace the borrow pits to facilitate the work of the elevating graders. The ridging of the borrow pits makes a smooth road for the Euclid Trac-Truks to travel while loading and makes it possible to load the Euclid wagons at the maximum loading speed.

The rolled fill operations include the use of sheepsfoot rollers and disc harrows, pulled with either Caterpillar RD-8 tractors or Allis-Chalmers HD-14 tractors. A bulldozer is attached to the front of the tractor to spread the windrows of earth into 8-inch layers of loose material. The sheepsfoot rollers make a minimum of ten passes over the fill. The rollers are weighted by filling the drums with sand and water so that they have a pressure on the feet of 310 pounds per square inch. Labor crews with pneumatic tampers compact the earth around the edges and in the cutoff trench.

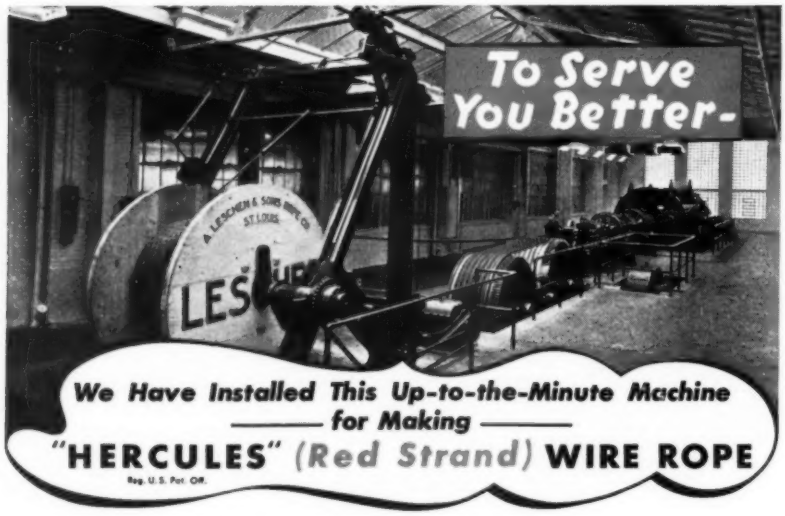
Quarry Operations

There is an exceptionally good dolomite (limestone) quarry located about 1¼ miles downstream from the dam site on the right bank of the river. The rock is removed by blasting, using four 9-inch electric churn drills for the blast holes. The holes average 120 feet in depth.

The rock hauling trucks are loaded by one 3-yard Marion electric shovel, one 3-yard Bucyrus-Erie 100-B electric shovel and one 2-yard Bucyrus-Erie diesel shovel. The rock is loaded into Euclid (10-cubic-yard) and Hug (12-cubic-yard) trucks to be hauled to the rock fill section of the embankments or to the crusher plant.

TVA's method of handling construction with its own forces permits taking advantage of studies and developments completed after construction is well under way. The plans are completed as expeditiously as possible and released to the field in advance of construction. One of the chief advantages of the method is its flexibility which permits its skilled and experienced construction engineering staff to keep abreast of the job and initiate new and alternate designs in the interest of over-all economy and utility.

The Cherokee project is being constructed under the general supervision of A. L. Pauls, chief construction engineer, and under the direct supervision of Lee G. Warren, project manager. George K. Leonard is the project construction engineer and G. E. Murphey is the project construction superintendent.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NOT in the *Contract*

Mountain Guide: "Be careful not to fall here. It's dangerous. But if you do fall, remember to look to the left. You get a wonderful view."

"Aren't those chimes beautiful? Such harmony. So enchanting."

"You'll have to speak louder. Those damned bells are making such a racket I can't hear you."

Police Sergeant — What, you back again?

Drunk — Uh, huh. Any mail?

"You look fed up, Mr. Jones."

"Yes, I've had a trying day. My office boy tried that old gag, about wanting the day off to attend his grandmother's funeral. I thought I'd teach him a lesson, so I said I'd go with him."

"Not a bad idea. Wasn't it a very good baseball game?"

"It wasn't a baseball game. It was his grandmother's funeral."

"Your son says he doesn't want to get married."

"Yeah? Just wait until the wrong girl comes along."

One thing men will never understand about women is how they manage to get into the garage on the last drop of gasoline.

There was a little girl
She had a little curl
Right in the middle of her
forehead
When she was good
She was very, very good
And when she was bad—
She was popular!

Visitor: If your mother gave you a large apple and a small one and told you to divide with your brother, which apple would you give him?

Johnny: D'ye mean my big brother or my little one?

Teacher: What is it that binds us together, sustains us, and makes us even better than Nature intended?

Tommy: Girdles.

A minister was asked by one of his least respectable members to offer prayers on Sunday for Anna Bell. The clergyman did so.

A few days later the pastor asked the member if he desired the prayers for Anna Bell to be repeated.

"No, thank you kindly," was the courteous reply, "She won last Monday at 7 to 1."

Maybe you can't make a silk purse out of a sow's ear, but a silk stocking certainly improves a calf.

The big husky brute who used to swagger around town bragging that he could walk a barb-wire fence in his sock-feet with a wildcat under each arm, married a little redheaded woman who makes him do the dishes three times a day.

Pop: "Well, I received a note from your teacher today."

Son: "Honest, Pop? Give me a quarter and I won't breathe a word about it."

Mrs. McTavish (looking out window): "Mack, here comes company for supper."

Mr. McTavish: "Quick, everybody run out on the porch with a tooth-pick!"

There was once a sculptor named
Phidias.
Whose tastes were extremely invidious.
He carved Aphrodite
Without any nightie,
Which shocked the ultra fastidious.

Judge: Now, sir, you may if you wish, challenge any member of the jury.

Prisoner: Well, I'm not in very good condition, but I believe I can lick that little guy in the end seat.

A survey gathered data to show that 50,000 girls have recently returned to cottontop hose. When at its height, this investigation must have been interesting.

"My, what an impact!"

Notes from the manufacturers

The Asphalt Institute, New York, New York, have suffered a sad loss in the death of their managing director, J. E. Pennybacker, who died February 25 at Delray Beach, Florida. Outstanding as an economist and road building authority, he played a leading part in the development of the present national highway system. Surviving him are his wife, Mrs. Louise Pennybacker; a daughter, Miss Caroline M. Pennybacker and Mrs. Francis Pennybacker Lockwood.

Gar Wood Industries, Inc., Detroit, Michigan, has announced the recent appointment of the following hoist and body distributors: W. T. Stringfellow & Company, 125 12th Avenue, North, Nashville, Tennessee; Southern Equipment and Tractor Company, Inc., P. O. Box 1892, Monroe, Louisiana; Oden Equipment Company, 312-24 North 4th Street, Albuquerque, New Mexico; and the Fruehauf Trailer and Equipment Company, 1943 - 4th Avenue, South, Seattle, Washington, and 906 N. E. 3rd Avenue, Portland, Oregon.

The New York State Society of Professional Engineers, Inc., 1941 Grand Central Terminal, New York, New York, will hold its Annual Convention at the Hotel Commodore, New York City, May 8, 9 and 10, 1941. Frederick H. Zurmuhlen, president of the society, announces that a feature will be an exhibit of equipment, supplies and methods in the engineering field. Companies supplying the engineering field will be the exhibitors. Because of the exhibit feature, the society will extend invitations to attend to all professional engineers in New Jersey and Connecticut, as well as New York.

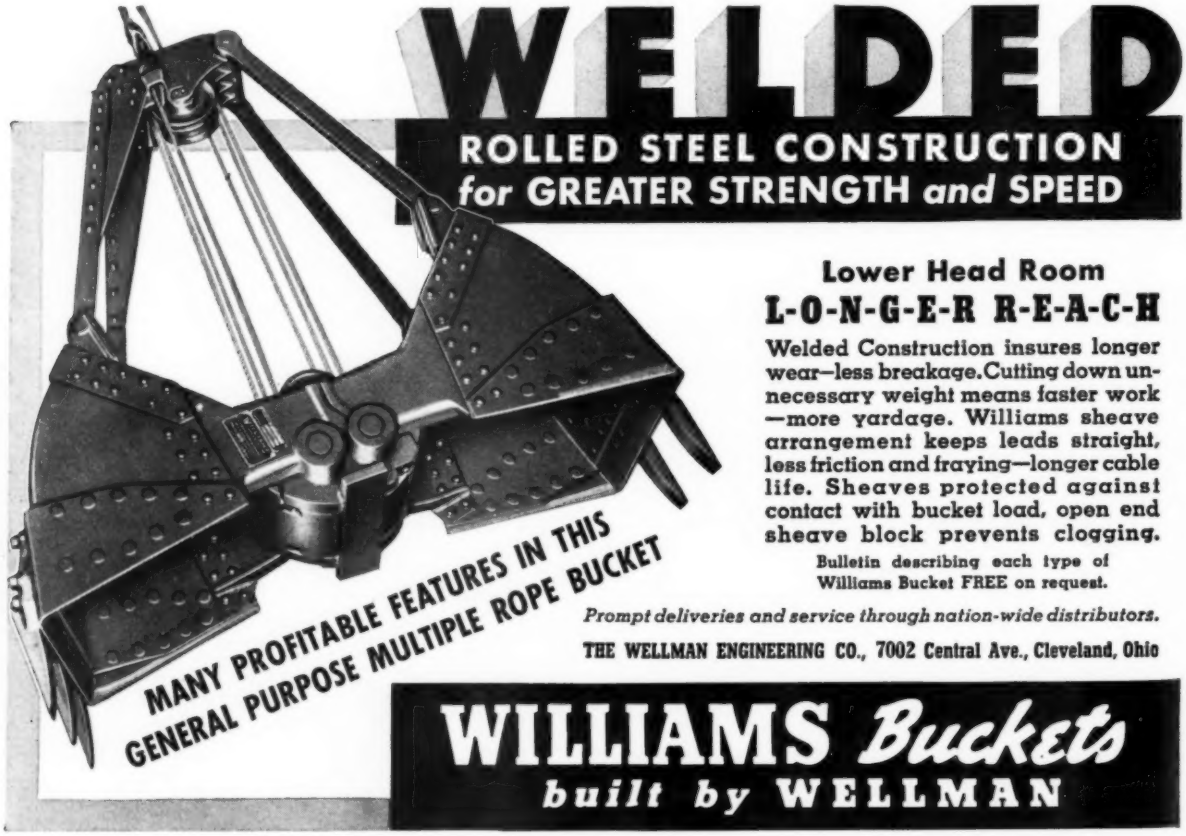
Chain Belt Company, Milwaukee, Wisconsin, at a recent meeting of their board of directors, elected J. C. Merwin president of the company to succeed C. R. Messinger who died February 4. A graduate of Yale University, he joined the Chain Belt organization in 1917 and has served as superintendent, works manager, assistant to president, director, vice president and treasurer.

Iron & Steel Products, Inc., Chicago, Illinois, dealers in iron and steel, have opened a branch office in Washington, D. C., American Security Building, in charge of Ernest W. Smoot, vice president.

General Electric Company, Schenectady, New York, recently appointed C. I. MacGuffie sales manager of their electric welding section, according to an announcement by J. E. N. Hume, commercial vice-president of the company. He succeeds L. D. Meeker, now associated with the Smith-Meeker Engineering Company, New York City.

Independent Pneumatic Tool Company, 600 West Jackson Blvd., Chicago, Illinois, will soon move to new headquarters at the corner of 17th and Fairmount Avenues, Philadelphia, Pennsylvania. This transfer is expected by the end of March. Also included in their building program is the erection of a new $500,000 plant in Los Angeles, California.

John A. Roebling's Sons Company, Trenton, New Jersey, announce that Ernest C. Low has been named general manager of sales. Mr. Low has been identified with the Roebling organization for thirty-two years. He was appointed manager of the San Francisco branch in May, 1930, and on January 1, 1940 was elected president and general manager of the John A. Roebling's Sons Company of California. Mr. Low assumed his new duties in March, with headquarters at Trenton, New Jersey.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Blast hole drill operator, 10 years' experience on gas, diesel and electric, large and small machines. Can do own repair work. Middle age, single and willing to go anywhere in U. S. A. Excellent references. Box 9160

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Operator with 20 years' experience on steam, diesel and electric draglines and shovels. Prefers steady work in rock quarry, gravel pit or strip mine. Tools. Experienced on repairs. Married, sober, reliable. Best references. Box 9166

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Three years' steady employment on Loomis Clipper "44," Cyclone piston type 1200-G and Bucyrus-Armstrong 27-T and 42-T, gas and electric blast hole drills on Penna. anthracite coal field. Able to make repairs. Unmarried. Age 39. Now located in Pennsylvania; willing to go anywhere. Can furnish best of references. Wants steady job on any blast hole drill: preference Armstrong. Box 9161

New trade literature

Title: "Making America Strong"

Subject: New 8-page folder illustrating and describing construction progress made by Carryalls, 'dozers, rooters and cranes on airport, roadway, water power, irrigation and housing projects. The Tournapull is also mentioned and shown at work on long haul earthmoving jobs.

Where to Get: R. G. LeTourneau, Inc., Peoria, Illinois. Free upon request.

Title: "Rex Mortar and Plaster Mixer"

Subject: Descriptive outline of the new mixer along with detailed specifications and dimensions.

Where to Get: Chain Belt Company, Milwaukee, Wisconsin. Free upon request.

Title: "Rex Pumpcrete"

Subject: This catalog describes the 1941 Pumpcrete models and includes information on pipeline handling, informative data on the types of jobs this unit is especially adapted to and complete specifications and dimensions for the machines themselves.

Where to Get: Chain Belt Company, Milwaukee, Wisconsin. Free upon request, ask for bulletin No. 382.

Title: "Simpac Power Units"

Subject: A leaflet containing a general description of the unit, giving its construction features and details. Each integral part of the device is fully covered.

Where to Get: Department 8-N-48, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pennsylvania. Descriptive data 3808 is free upon request.

Title: "Longitudinal Finisher"

Subject: A complete presentation describing the construction features and illustrating the application of this unit for preparing the surface of the concrete highway slab.

Where to Get: Koehring Company, 3026 West Concordia Avenue, Milwaukee, Wisconsin. Free upon request.

Title: "Pressure-Creosoted Laminex Culverts"

Subject: Prefabricated culverts which can be erected by unskilled field labor and which withstand loads in excess of 20,000 pounds are described in this booklet. Drawings and photos show how they are assembled and their advantages in certain fields is listed, along with a table of sizes obtainable. Details of the material used are also given.

Where to Get: Koppers Company, Wood Preserving Division, Pittsburgh, Pennsylvania. Free upon request, ask for form G-16.

Title: "Canadian Mines Handbook (1941)"

Subject: An authoritative report covering 5,760 Canadian mining companies. Those still operating are reviewed in comprehensive detail, with a five-year comparison of output, earnings and other essential matters. An eight-year range of quotations is provided.

Where to Get: Northern Miner Press Ltd., 122 Richmond Street West, Toronto, Canada. Price $1.00.

Title: "Mayari R"

Subject: A general, yet thorough description of this low-alloy, high-strength steel, featured by illustrations of the many forms of application and usage.

Where to Get: Bethlehem Steel Company, Bethlehem, Pennsylvania. Free upon request.

Title: "Diesel D7 Tractor"

Subject: Printed in three colors, the booklet points out the new tractor's

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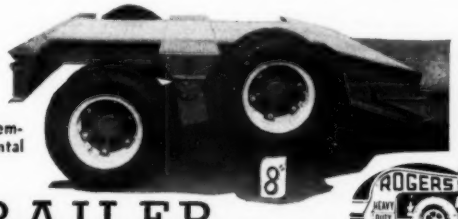

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Write for information on standard or special trailers which have been tested in difficult service.

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ROGERS HEAVY DUTY Quagmire Trailers

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features by the use of numerous illustrations with the accompanying text giving a complete description of all working parts. A complete tabulation of specifications is also included.

Where to Get: Caterpillar Tractor Company, Peoria, Illinois. Free upon request.

Title: **"Buda-Hubron Earth Drill"**

Subject: The adaptability of this installation to various jobs is fully explained. A list of users and their statements along with the types of earth drills is also included.

Where to Get: The Buda Company, Harvey, Illinois. Free upon request. Ask for bulletin No. 1019.

Title: **"Ransome Truck Mixers and Agitators"**

Subject: Eight page bulletin containing actual job illustrations, suitable descriptive material, and a complete list of the unit's points of superiority.

Where to Get: Ransome Concrete Machinery Company, Dunellen, New Jersey. Free upon request, ask for bulletin No. 175.

Title: **"After All, Planes Must Land"**

Subject: Description of the worthwhile advantages of Armco perforated pipe on airport jobs.

Where to Get: Armco Drainage Products Association, Middletown, Ohio.

Title: **"Cummins Dependable Diesels"**

Subject: Profusely illustrated catalog containing pertinent information about Cummins diesels. Specifications also included.

Where to Get: Cummins Engine Company, Columbus, Indiana.

Title: **"How Precision Insures Caterpillar Quality"**

Subject: Clear view of the care and accuracy necessary to produce machines that meet the company's rigid standards. Machines and gauges which are necessary for this kind of production are discussed and photographed. Printed in two color and profusely illustrated.

Where to Get: Caterpillar Tractor Company, Peoria, Illinois.

Title: **"LeTourneau Earthmoving Equipment"**

Subject: A new 48-page, pictorial condensed catalog covering the entire line of LeTourneau earthmoving equipment, with complete specifications of each unit and its application. Working features of the different machines are diagramed, pictured and described.

Where to Get: R. G. LeTourneau, Inc., Peoria, Illinois. Free upon request, ask for form A-11.

Title: **"Tellurium Portable Cable"**

Subject: A discussion of the cable's properties, application, current-carrying capacities and other physical data. The various types for different jobs are also dealt with.

Where to Get: General Electric Company, Schenectady, New York. Free upon request, ask for bulletin GEA—1918B.

Title: **"All-Wheel-Drive"**

Subject: A story of the conversion of Ford trucks, passenger cars and commercial cars to all-wheel-drive. The possibilities of these units are stressed with accompanying action photographs and specifications.

Where to Get: Marmon-Herrington Company, Inc., Indianapolis, Indiana. Free upon request.

FOR SALE

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BUCYRUS-ERIE 1030 Gas Combination Shovel. Clamshell, and Drag Shovel with three dippers. Electric starter. Wisconsin engine. Recently thoroughly rebuilt. Located Massachusetts. Box 2653

NORTHWEST Model 80-D 2½-yard Shovel. Twin City oil engine. Excellent condition. Located Chicago. Box 2728

LORAIN MODEL 87 2-cu. yd. Shovel. Caterpillar Diesel 17,000 engine. Kohler light plant. Excellent condition. Located near Pittsburgh, Pennsylvania. Box 2689

LORAIN 75-B Combination 1½ yd. Shovel and Dragline. Waukesha gasoline engine—just overhauled. Located Eastern Pennsylvania. Box 2686

NORTHWEST MODEL 85 Dragline. 80' Boom, 2-yd. Basket Type Drag Bucket. Light Plant. Twin City Oil Engine, 4 cylinder 8"x9". Only used 21 months. Located Louisiana. Box 2694